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ABSTRACT

This teaching guide contains 20 activities on population growth for students in grades 6-12. The purpose is to help students gain the skills, knowledge, and understanding of population dynamics so that they can make rational decisions and take responsible action regarding population matters and public policy. Activities are organized around the population dynamics of growth, size, density, and distribution as well as demography. Each activity is based on an assumption. For example, "World Population Data Sheet" proves that the earth's human population is distributed unevenly over the earth's surface. Other assumptions are: the earth is a finite system; population is a group of organisms limited in time and space; specific factors determine the size and makeup of a population; desired population size depends on people's wants and expectations; world population is growing rapidly because of a reduction in the death rate; organisms need specific external resources to support life and they require space; and population is a major factor in human/environmental interactions. Each activity contains an introduction and a list of objectives. It includes information about grade level, time required, and materials needed. The procedure to follow is explained and ideas are given to evaluate the performance of students. There are handout and supplementary materials. A pretest/posttest is provided. (Author/NE)

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TEACHING ABOUT POPULATION GROWTH

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TABLE OF CONTENTS

Introduction..... 1
- Background..... 2
- Assumptions..... 4
- Format..... 5
- Objectives..... 5
- Evaluation..... 6
- Population and the Curriculum..... 6

Pretest/Posttest..... 9

The Individual: A Population Actor.....15

Find A Million.....29

Car Watching.....31

Birth and Death.....35

World Population Data Sheet.....39

Hide and Seek: Where is Everybody?.....61

Limits.....67

Census.....75

Does Strength Lie in Numbers?.....93

One Man's Family.....99

If I Could Live Any Place on Earth.....107

Graphing Population Growth..... 113

Footprints..... 121

Modeling Population Growth..... 125

World Population..... 135

The Letter..... 137

The Numbers Game..... 145

Nobody Ever Dies of Overpopulation..... 147

Population Projections..... 151

People per Square Kilometer..... 167

Evaluation Questionnaire..... 173

Volume 1

Spaceship Earth

To see the earth as it truly is, small and blue and beautiful, in that eternal silence where it floats, is to see ourselves as riders on the earth together, brothers on that bright loveliness in the eternal cold--brothers who know now that they are truly brothers.

Archibald McLeish

INTRODUCTION

Population education can be defined "as the process by which students investigate and explore the nature and meaning of population processes, population characteristics, the causes of population change, and, most important, the consequences of these processes, characteristics, and changes for himself, his family, his society, and the world."[1]

The focus of such a program is not to propagandize or indoctrinate. Population education sees population not as a "problem" to be solved, but as a "phenomenon" to be understood. This volume focuses on population dynamics with the expressed goal of providing knowledge and understanding which are necessary for taking responsible action regarding population issues. The second volume explores a number of population issues providing students with the information and structure to analyze issues resulting from the specific nature of human population dynamics. It is the author's feeling that material can be used from both volumes simultaneously as long as the goals of population education are being addressed. The best overall statement of this goal is found in the report just quoted.

"The goal of population education is to assist students to conceptualize the relevance of population for themselves, to assist them thereby to make rational and responsible individual and collective decisions about population matters utilizing appropriate

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[1] Population Education, "Science for Society, Education Review," Commission on Science Education. Volume 2, No. 4., December, 1972.

information and analytic skills. For the family the goal can be stated as responsible fertility behavior, for the community, as rational and responsible decision on population and public policy."[2]

These supplementary activities are provided as examples of useful approaches to the study of population growth and population issues. If used as supplements to the regular curriculum or as models for teacher adaptation, these activities provide ready-to-use instructional tools for population education, grades 6-12.

Background

Each of us will confront the effects of today's population trends in the decades ahead. Because of the time lag between what action is taken and its eventual effects on human life, it is important to begin today to find out--on a global scale--where the human population is headed.

At best count, more than 74 million individuals were added to the world's population in one year--and the increase is greater annually. Is this fact going to continue indefinitely? How can members increase at such a rate? What causes increases in human numbers? These questions all relate to population growth and dynamics. Answers to such question are necessary in developing the knowledge base needed to deal with the realities, issues, and problems presented to us by population growth.

There are many viewpoints regarding the effects of population growth on the earth and its resourses. Some believe global catastrophe

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[2] Ibid.

already threatens the human race due to vast population increase. This gloomy outlook is only enhanced by the increased effects and demands of industry and technology. Others are more optimistic, seeing solutions in terms of technological progress that can meet the needs of many more people than presently occupy the globe. Many people now see the answer in the way we define the problem. To many we are making a mountain out of a mole-hill when we see population growth as a crisis. It is a factor to deal with but certainly not the major concern confronting humans today.

Yet, even if it is argued that the momentum of present world population growth has alarming prospects for the future, a primary concern in examining population growth is with the focus or perspective one uses in defining population problems. "Given the fact that there is a complex interrelation of population with social, economic, political and cultural factors, we would say that the population problem lies in whether or not we strike a proper balance between the size, growth, and distribution of population, on the one hand, and the quality of life to which individuals and nations aspire, on the other."[3]

To strike such a balance implies a knowledge and understanding of population dynamics related to size, growth, and distribution, as well as ability and skill in reading and analyzing demographic data.

As necessary as this knowledge and skill may be to those of us who study population, such an education may be far from the interest or concerns of young people in grades 6-12. That does not negate the importance of communicating population growth to students. It does mean that as educators, attention must be given to the fact that many

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[3] Youth and Population, Report of the Working Party on Youth and Population, (Turin, 17-21, July, 1972), United Nations, p. 14.

students will not want to learn about population growth, especially if they have to read charts and graphs and use statistics.

The following activities are designed to present accurate data about population dynamics in a variety of formats and approaches to increase the likelihood that students will eventually share our interest and concern about rapid population growth and its effects on our lives today and tomorrow.

Assumptions

In developing activities for classroom use, especially supplementary activities, it is important to share the assumptions that activities are based upon. These assumptions comprise the content of many of the activities and will provide guidelines in selecting activities which address the assumption that needs reinforcement in the classroom.

1. Earth is a finite system.
2. Population is a group of organisms (people) limited in time and space.
3. Specific factors determine the size and makeup of a population.
4. Desired population size depends on people's wants and expectations. These wants and expectations vary and therefore desired population size varies.
5. The earth's human population is distributed unevenly over the earth's surface.
6. Due to world-wide reductions in the death rate, world population is growing at a rapid, exponential rate.

7. Organisms need specific external resources to support life (primarily food and exygen) and these life support systems require space.
8. The number of people directly influences the quality of life and distribution of goods and services.
9. Nations take census information in order to plan for meeting the population's needs and wants.
10. The population growth rate is related to many environmental and social problems.
11. Population is a major factor in human/environmental interactions.
12. Individuals need to know population patterns in order to understand our world.

Format

The activities are organized arond specific aspects of population dynamics. These include the following topic areas:

1. Population growth
2. Population size
3. Population density
4. Population distribution
5. Demography.

Each activity includes a short summary which gives the specific area or areas of population dynamics dealt with in the activity.

Objectives

The objectives in this collection relate generally to three broad areas of population education.

1. Students will increase their knowledge and understanding of population growth, size, distribution, and demography.
2. Students will develop skills related to collection, reading, and analysis of population data.
3. Students will better understand themselves as population actors who are capable of having positive influence over individual group behavior related to population.

The activities selected by the teacher should attempt to address all three of these broad objectives.

Evaluation

Each activity includes ideas for evaluating the performance of students. Most of the evaluation serves as a check on student progress and learning and is for the benefit of the student.

If necessary the activities can be used in evaluations for grades and reports to parents, although the activity may lose much of its effectiveness if external evaluation becomes a major goal in using the activity with students.

Population and the Curriculum

Most schools do not have a formal course in population. In fact, most population educators favor an approach to population education best identified as curriculum infusion. "The inter-disciplinary nature of population education makes it ideal for special courses, but it is most often integrated where relevant into seperate disciplines--biology, social studies, humanities and other areas." This infusion can and should occur in many different

subject areas. These activities are designed to be used in language arts, social studies, science, and math classes. A teacher presenting world affairs and geography to students could easily include an examination of the concept of dependent populations and population density comparatively between regions of the world. U.S. History topics present excellent opportunities to examine population dynamics. The most outstanding example is that of immigration as a component of population change.

I. Population Dynamics

A. Social Studies topics

1. Geography-World Affairs

a. The Demographic transition--Modernization and Economic Development

b. Dependent populations--Importance of age structure

c. Population distribution and history--factors

d. Population density--causes and effects

2. American History

a. Population Distribution--Formation of Village Communities

b. Natural Increase in Early America

c. Immigration

d. Taking a Population census

e. Population Distribution--Rise of Cities--economic growth

f. Values and demographic behavior

g. The individuals contributions to societal demographic trends

h. Population density and quality of life

i. Estimates and projections of population change

Title: PRETEST/POSTTEST*

Introduction:

An important aspect of any teaching unit is an evaluation of changes that occur as a result of that unit. If a unit on population is to be taught, then the attached pretest/posttest is an excellent and concise instrument to evaluate the cognitive progress that may take place during the unit. The pretest/posttest will not only measure changes which occurred during the unit, but it will give the teacher a basis for determining change that should be made when teaching that unit in the future.

The test should be administered at the beginning of the unit, prior to any instruction. The scores for the cognitive portion should be recorded, and the average score determined. At the end of the unit, the same test should be given and the scores recorded in the same way as recorded earlier. This will show the degree of improvement in the cognitive knowledge of the students.

Objectives:

To evaluate how much factual learning took place in the unit.

To document student knowledge of basic population growth dynamics.

Grade Level: 7-12

Time: 20 minutes at two different times

Materials: Copies of the pretest/posttest for each student

Procedure:

1. Prior to teaching any of the population unit, pass out the pretest/posttest and ask the students to answer the questions.

*Taken from an activity in Equilibrium.

The testing may be done anonymously at the teacher's discretion. Ten minutes should be sufficient time for the test.

2. After the tests are collected they should be scored, with the average score calculated for the class.

Answers:

1. c
2. b
3. c
4. d
5. d
6. a
7. c
8. a
9. b
10. e

Part I: DO YOU KNOW THE FACTS ABOUT POPULATION? (circle the letter of the best choice)

1. What is the population of the world today?
   a. 900 million
   b. 2.2 billion
   c. 4.4 billion
   d. 7.4 billion
   e. 22 billion

2. What is the present rate of growth of world population?
   a. 0.7 percent
   b. 1.7 percent
   c. 5.1 percent
   d. 9.8 percent
   e. 24.3 percent

3. If world population continues its present rate of growth, how long will it take to double?
   a. 10 years or less
   b. approximately 20 years
   c. approximately 40 years
   d. approximately 85 years
   e. approximately 120 years

4. What is the population of the United States today?
   a. Under 55 million
   b. About 75 million
   c. About 115 million
   d. About 225 million
   e. Over 5000 million

5. If the U.S. population continues to grow at its present rate, how long will it take to double?
   a. 10 years or less
   b. approximately 20 years
   c. approximately 35 years
   d. approximately 100 years
   e. approximately 120 years

6. Which of the following countries has the greatest number of people?
   a. China
   b. India
   c. United States
   d. Soviet Union
   e. Brazil

7. Which of the following countries has the fastest growing population?
   a. Soviet Union
   b. United States
   c. Mexico
   d. West Germany
   e. India

8. In the less industrialized countries . . .
   a. birth rates are high
   b. death rates are high
   c. literacy rates are high
   d. per capita income is high
   e. population growth rates are low

9. Which has not been a major cause of the population explosion?
   a. modern preventive medicine
   b. increase in birth rates
   c. improved sanitation
   d. lower infant mortality
   e. longer life span

10. What portion of the U.S. population growth is due to immigration?
   a. under 5 percent
   b. 5 percent to 9 percent
   c. 10 percent to 14 percent
   d. 15 percent to 19 percent
   e. 20 percent and over

Title: THE INDIVIDUAL: A POPULATION ACTOR

Introduction:

We do not like to see ourselves as statistics; however, much of what we do is combined with the behavior of others and becomes demographic data. We are all individual population actors. Each of us in our own way contributes to the statistics that are compiled on a population group, whether it is local, state, national, or global.

The focus of any examination of population dynamics is on the individual and his or her behavior, especially when conscious decisions can be made by each of us which affect the total quality of life for everyone in the population.

Objectives:

Students will be able to identify and discuss their individual behaviors as they affect population growth.

Grade Level: 7-12

Time: One hour for reading, one hour at home to fill in survey, and one hour in class to compile and discuss survey results.

Materials: Copies of "Each of Us: A Population Actor" and "Personal Population Profile" for each student. You will need to make copies or a transparency of "Population Profile--Composite" for use in class discussion.

Procedure:

1. Explain to the students that every population is comprised of individuals. Discuss these questions: How many individuals are there in this classroom population? Did the students include absentees? Are they part of the population? What behaviors, such as being absent, do individuals perform that affect the size, distribution, or growth of the classroom population? (Some answers include working in library, leaving to participate in

special events, and walking around the room.) Ask students to read the article "Each of Us: A Population Actor" and identify at least 10 behaviors in the reading that affect the size, distribution, or growth of the U.S. population. (Note: for younger students, this reading can be summarized by the teacher or skipped entirely.)

2. After a short review of the reading with students sharing their lists of identified behaviors, hand out a copy of the Personal Population Profile to each student. Have them fill out the form as completely as they can.

3. Divide the class into groups of five students when they have completed the forms. Hand out a "Population Profile--Class Composite" to each group. Have the groups fill in the form using data from group members' Personal Population Profiles.

4. Hold a class discussion and analysis of the composites. Compile <u>selected</u> information from each group, using a transparency of "Personal Profile--Class Composite" or tabulating information on a blackboard. Ask the class to identify visible trends and facts reflected in the composite data. Some items to note would be:
   a. Average number of times students have moved.
   b. Average size of family compared to desired family size of students.
   c. Ages of parents when they were married.

5. Which of the responses that students provided do they feel they have control over? Discuss by identifying those behaviors over which they have a major influence, those over which they have a marginal influence, and those actions which they feel they cannot influence at all. How do each student's ratings compare with those of others in the class?

<u>Evaluation</u>:

One good way to have students summarize their knowledge of themselves as population actors is to communicate in a collage those behaviors that relate to population dynamics. The collage should communicate how students' individual behaviors contribute to and/or affect population size, growth, or distribution. As the data chart was one way to form a composite image of the class, so is the collage another way for a small group to express themselves as population actors.

Have students work in pairs or trios. Using the data from their personal surveys and any other data, have them make a collage titled, "Population Actors," followed by each student's name.

II EACH OF US: A POPULATION ACTOR

OPTIONS: A Study Guide to Population and the American Future, The Population Reference Bureau, 1973.

Whether we are conscious of it or not, whether we intend it or not, each of us is a population actor. Each of us participates in population processes. Sometimes we have control over these processes; other times not. Sometimes we are aware of our influence; too often we are not.

For instance, none of us has control over our own birth or death, yet each of us contributes to the country's birth rate and death rate. When we as individuals can choose whether to marry and when, the number of children to have, where to live, how to get to work, or where to spend vacations, we have control over population-related actions. All of these actions involve us in population processes.

But few of us are completely free to live *as* we choose or *where* we choose. A decision to move from the city to the suburbs, for instance, is affected by such practical realities as the opportunities for jobs, transportation, housing, and credit. Racial and sex discrimination also inhibit our freedom to move at will. Nor is it reasonable to expect that a man and woman can plan each birth if they don't have access to both fertility control information and services.

We are all participating in population change, but no one of us can create or solve the resulting problems alone. Population problems *affect* us individually but *result* from an aggregate of decisions.

Consider the patterns of population distribution that have led to the growth of our large metropolitan centers. The movement of people into suburban communities surrounding U.S. cities has sharply changed the patterns of residence in this country. At the turn of the century, half of all Americans lived on farms or in small villages. Today seven of every ten persons live in metropolitan areas, that is, in cities of 50,000 or more and the surrounding counties that are economically integrated with them. Between 1960 and 1970 the metropolitan population of the United States grew 23 percent, largely through the growth of suburbia. Future metropolitan growth will occur with the continued expansion of these suburban areas.

An aerial view of a metropolitan area may give the misleading impression that the suburbs were developed in accordance with some grand blueprint. But this redistribution of population involved thousands of separate decisions made by individuals and groups who acted as home-buyers, builders, realtors, and lenders. This transformation is one of the most impressive results of population changes in the nation's history. Combined with poor planning, it has resulted in some of our worst problems—congestion, pollution, and shortage of recreation space.

Who builds suburbia? Population actors—people who move to the suburbs or who somehow influence others to move. It's not often that the people who are moving consider the demographic consequences of their decisions. Nor is it realistic to expect such decisions to be geared to the likely population outcome. Many of us have no choice in this matter. We move because of housing costs, location of available jobs, and other factors. But at least by acknowledging the impact that we make collectively, we realize our stake in the process of community planning. If community consequences are ignored, the quality of common or public resources easily can deteriorate.

The problems resulting from population movement do not simply involve more or fewer people. The speed with which a community gains

or loses people, or the rate of change, is often at the core of adjustment problems. Migration, both in and out of a community, signals a process of adjustment between the changing population and the social and economic activities of the community. The settlement patterns of today's 5 million young adults, who are marrying and becoming parents, will determine where future population growth occurs and where added demands for housing, health, and education services will be felt.

Clearly, we participate and have an important stake in a variety of population processes. The following discussion of life cycles may help us see our own roles as population actors more easily.

Birth: We've All Been Through It

The birth of a new baby usually fills parents with a mixture of feelings. Tenderness and love may predominate, but there are also realistic concerns about the responsibility, the expense, the pile of diapers, and the midnight feedings. It is hardly surprising that parents don't also think of their newborn son or daughter as a "population event."

To its parents, the newborn is Larry or Carrie, Jerry or Beth. To society the newborn will be an addition to school enrollment, the labor force, the armed forces and a consumer of social and health services.

In the hospital nursery all babies appear to be much alike with the same prospects before them. But they are not alike. All are born as the result of the actions of an earlier generation of population actors; their advent into this world may have been an intended or — unfortunately — an unintended consequence of their parents' sexual activity. For a variety of reasons—including youthful marriage or accidental pregnancy—many parents will have children before they want them and many will have more children than planned. According to a recent national study 44 percent of all births between 1966 and 1970 were unplanned, and 15 percent were reported as having been unwanted.[1]

It would be a mistake, however, to assume that all unwanted pregnancies necessarily result in unwanted children. Many, perhaps most, of the children are eventually accepted and loved.

All the children born during the same year have one thing in common. They are members of the same birth cohort. Recession, wars, and certain other economic, political, and social events will occur at the same points in the lives of each member of that cohort.

Babies born in 1920 experienced the Great Depression that began in 1929. World War II was another event shared by this cohort. Many died in that war; for others, marriage and childbirth had to be postponed until after the war. This cohort's contribution to the postwar "baby boom" can only be understood if we take these earlier events into consideration. Similarly, the cohorts of persons born during the 1970s will be affected by coming shifts in the economy, by swiftly changing sexual and social mores, by the extent to which racial discrimination continues to inhibit equal opportunity, by new attitudes toward women, and by our awakening concern for the environment—all these will shape the values of the generation now growing up.

Growing Up—Picking Up Roles

A child does not make many population decisions directly, but he learns the values that will condition decisions made later in life. The young child observes the daily activities of family life and begins to understand the responsibilities involved in creating a home. It is here that the child initially learns his role as a population actor. Later, these roles are reinforced or challenged by other influences—school, church, peers.

A number of population events can and do occur during this period of the child's life. The birth of brothers or sisters creates changes that will affect the family and each member in it. Additions to the family will affect its financial and emotional resources and thus will influence the development of each child. Similarly, because of changes in the father's or mother's employment, or for some other reason, the family may move from one place

[1] 1970 National Fertility Study conducted by the Office of Population Research, Princeton University.

to another. The migration of this family may have important consequences for the child as well as for others. The community may or may not be prepared to provide his parents with satisfactory housing and adequate social services or to welcome the child into a new school or playground.

Coming of Age—Decisions, Decisions

A crucial period stretches between the ages of 15 and 25. During this time the population actor is faced with a series of decisions: whether to go on to college after completing high school, the selection of a vocation or profession, where to live and work, if and when to marry and if and when to have children. Some of these decisions will be made consciously, others unconsciously, and still others will be made automatically in accord with the values and expectations learned in childhood.

Most young population actors take marriage for granted. A majority not only marry, but they marry at about the same period of their lives. In 1970 the median age at first marriage was 23.2 for men and 20.8 for women. An overwhelming majority of these couples expect to have children and most want two or three. Such conformity is not coincidence; it indicates that most of us are following accepted behavior patterns. But not all population actors follow these common patterns of childbearing. For some, larger families are desired. For others, babies arrive too often or too early. Just as the population actor may have been "unwanted" or "unplanned," his children may arrive in the same fashion.

Girls who become pregnant as adolescents face particular problems. In 1968 more than one of every six children was born to a mother under 20 years of age. More than 25 percent of these children were born out of wedlock.[1] A national study of unmarried teen-aged girls indicated that 14 percent of the 15-year-olds and 46 percent of those who were 19 reported having had sexual relations. Yet only 20 percent of these girls used contraception regularly.[2]

Clearly, teen-agers and young adults face an almost bewildering array of events, each of which will influence later behavior. Decisions faced at this age are not limited to reproductive activity. Late adolescence and early adulthood are also periods in which the first decisions are made about migration. Nearly 40 million Americans, or one in five, move each year. About one-third of these migrants are in their twenties and move to take new jobs or to finish their education.

The Middle Years

These are the years in which the role of citizen is the crucial one for population actors. Through the electoral process and group action, every individual has an opportunity to help make decisions about numerous policies affecting his community, state, and nation. Population processes are often affected by these public decisions regarding land zoning, recreation and housing, education, day care programs, health services, and so on. All these decisions may have substantial influence on population change, both locally and nationally.

These middle years also are a time when most of us are highly productive in the economic sector as well as in the home. The burden of supporting the dependent members of the population—the sick and disabled, the very young and the very old—is heaviest during these years.

Retirement: Looking Back

In retirement the population actor is able to look back at a society that he helped to shape. The course of population growth as well as the issues confronted in suburbia, rural areas, and urban centers were influenced by his decisions. But perhaps most importantly, his decisions about reproduction have helped to set forces into motion that will continue for a long time. As the population actor completes his lifetime, his grandchildren will begin to have children of their own. This fourth generation and those who survive from the three that precede it will form the population of the United States in the middle of the twenty-first century.

[1] Commission on Population Growth and the American Future, *Population and the American Future* (1972), p. 88. Cited hereinafter as Commission Report.

[2] Ibid., p. 85.

Personal Population Profile

A. Personal Characteristics

Age_____ Year of Birth _____ Sex_____ Ethnic/Racial Identification_____

Birthplace_____ Approx. Pop. Size of Birthplace_____
Town or City

Intend to Marry? Yes/No If yes at what age?_____ Number of children you expect to have_____

B. Your Ancestors

	Birthplace	Present (final) Residence	Life span
1. Grandparents:			
mother's mother			
mother's father			
father's mother			
father's father			
2. Parents:			
mother			
father			

At what age did they marry? _____ mother _____ father

You are No._____ of_____ children

C. Places You Have Lived

Name of Place	Rural Urban Suburb	How long did you live there?
1.		
2.		
3.		
4.		
5.		
6.		

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D. Your Present and the Next Few Years

Do you plan to marry?_____ Why?_____

When?_____ Why then?_____

If not, what alternative living styles would you prefer?_____

_____

If yes, do you think your spouse will be older or younger?_____

Do you plan to have children?_____ Why?_____

_____

Number of children you expect to have_____ Why?_____

_____

At what age would you like to have your first child?_____

How long after marriage would this be?_____ Why is this the time?_____

How many more or fewer children do you want than your parents had?_____

Why?_____

Where do you expect to live?_____ Why?_____

_____

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PERSONAL PROFILE--CLASS COMPOSITE

	Number
Range of birthplace by size of population:	
Under 2,500	_____
2,500-10,000	_____
10,000-50,000	_____
50,000-100,000	_____
100,000-500,000	_____
Over 500,000	_____

How many different states are represented?_____ **countries?**_____

Present residence:	
Living in same house as at birth	_____
In same town	_____
In same state	_____
In same country	_____
Intention to marry:	
Males intending to marry	_____
Females intending to marry	_____
Average number of births expected:	
By all persons in the group	_____
By all females in the group	_____
By all males in the group	_____
Average number of siblings, plus one	_____

Average number of moves_____

Average number of moves for parents_____

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Title: FIND A MILLION

Introduction:

For many people, a million is a number with a vague meaning. It is often difficult to get a handle mentally on the meaning of having a million of something. This activity gives students the chance to explore the notion of a "million" in several contexts taken from their own environment. This should help students understand what a million is by broadening their knowledge of quantities such as a million dollars, or a million people. In addition, students are encouraged to brainstorm, invent, and explore, utilizing important thinking skills.

Objectives:

To involve participants in recognizing, documenting, and proving the existence of a million of something.

To familiarize participants with the concept of a million by utilizing the participants' own environment.

Grade Level: 6-12

Time: One class period

Materials: None needed for this activity.

Procedure:

1. Tell the group to go outside and find a million of something. After they have done this, tell them to prove that they have a million.

2. Students will not respond immediately because the task seems so difficult. Give them time to think about and discuss the task, yet don't give answers. Once the group determines or discusses a few examples, the list will appear never ending.

3. Make a list of all the items found; of all the items proven. Discuss these questions with the group:

a. Did this exercise make a million any more understandable?
b. Does a million seem to be a bigger or smaller number than it appeared to be before completing the activity? Does it appear to be the same?

Further Suggestions:

1. Have students find a million of something and bring it to class.

2. What different kinds of items can students think of, such that a million of the item would fit into a three-foot box?

Title: CAR WATCHING

Introduction:

Kids often spend their time in small groups, discussing a wide variety of topics while sitting in a front yard or next to a street. This activity capitalizes on the fact that people do spend their time in this way. Students are encouraged to learn about population dynamics by observing and recording what happens on their local street corner.

Objectives:

To develop student observation and recording skills.

To utilize community sources in studying population dynamics.

To help students develop hypotheses about the people in their community after collecting data.

To document in the students' minds the relationships of a simple daily activity to population dynamics.

Time: One hour out of class; one class period for discussion of results

Materials: Car Watching Observation form for each student

Procedure:

1. Ask the students if they have ever sat on a street corner and talked with their friends. Let students relate some of their experiences.

2. Tell the students that you would like them to do some car watching while they are sitting on a curb one evening or afternoon. Tell them to take a half hour or an hour and observe what happens at the street corner. Have them count something that catches their attention. Below are some examples of things that might be counted. There are many, many more possibilities. Brainstorm other items to observe.
   - Number of people in each car
   - Number of cars going in each direction at particular times of the day
   - Number of women drivers

Number of men drivers
Number of people wearing sun glasses
Number of people in foreign cars
Number of people in small cars
Colors of automobiles
Facial expressions of drivers

3. Hand out the observation form. Have students fill in the form as they make their observations.

4. Once students have collected their data, have them bring the data to the class and report it. Their data can be recorded on the board or on ditto sheets so that the information is available to all students for analysis.

5. Ask the students to make some hypotheses about the people in the community, based on the data they have collected.

EXAMPLES:

People use the car as a means of individual rapid transit.
Most people in the community have poor eyesight.
People in the community do many things individually between 3:00 and 4:00 o'clock in the afternoon.
People drive around more from 4:00 to 5:00 than from 5:00 to 6:00 o'clock.
Men are better drivers than women.
Men prefer to drive more than women.
When a family is going somewhere, the men usually drive.
In the afternoon, more people are going away from town than toward town.

6. Students should suggest ways to find out if the hypotheses are true. For example, if it is true that men prefer to drive more than women, what other things would the students expect to find in the community to verify this fact? (More men apply for drivers licenses; more accidents are recorded when a man is driving while both a man and a woman are in the car; etc.) If there is time and interest, students should test their hypotheses. If not, you should make it clear that these hypotheses are only tentative generalizations from limited but <u>useful</u> population data.

7. If students have a difficult time generating hypotheses, you might have them pretend to be people from another planet. They have observed these things about a group of people and are going to report back to the leaders of their planet, using the data to state what the observed people are like.

<u>Evaluation</u>:

In concluding the discussion, ask the students if they think the data they gathered are similar in any way to the data collected in a census. If the students say "yes" and give examples, they probably have seen the connection between data collection and population dynamics. We count, we generalize, we test, we generalize again.

CAR WATCHING

Observation Form

Place_____ Date_____

Time_____ Name_____

_____

Item being observed*

_____

Car#

Other categories needed to record information such as color, number of people, four directions, etc.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____

*You will need a code for recording the data. For example, if you want to know the number of male and female drivers, you can use (F) for females and (M) for males.

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Title: BIRTH AND DEATH*

Introduction:

Reading a graph is an important social studies skill. Interpreting a graph is also an important skill. This activity focuses on these two skills, using the inquiry approach to learning. The inquiry approach provides the motivation to interpret the charts. In this exercise students will attempt to identify countries from their birth and death rates given on charts.

Objectives:

To improve student ability to read and interpret graphs and charts.

To make hypotheses and establish criteria for testing the hypotheses.

To better understand birth and death rates and their relationships with population growth.

Grade Level: 8-12

Time: One or two class periods, depending on student interest and discussion

Materials: Duplicate copies of the student handout, "Birth and Death Rates."

Procedure:

1. Hand out the "Birth and Death Rates" charts. Ask students to explain what kind of information is included on the charts. They should determine what all the symbols represent.

2. Have students note similarities and differences between the charts. For example, Country 3 is somewhat like Country 4 in the pattern of birth and death rates.

3. Ask students to decide which countries the data belong to. Students may have to begin by indicating general areas of the world. Ask them what clues they can obtain from the charts? (i.e., historical, developmental, comparative.)

*Adapted from an activity by Byron Massialas.

4. As students attempt to identify the countries, ask them how they can verify their hypotheses. For example, if country 4 is Egypt, what data would be needed as verification?

5. Let students spend one or two days gathering information. This can be done on an optional basis by some students only, if others are not interested.

6. After a few days have elapsed, initiate another discussion. Have students come to any conclusions? Have any changed their opinions? Have some lost interest? Are there disagreements about the facts or hypotheses? NOTE: You may decide to inform students of the correct answers, but it is recommended that they pursue the lesson until they feel relatively comfortable with their own hypotheses before you provide the answers. At times, you may decide not to give the answers at all.

Answers:

Country #1 is Japan.
Country #2 is Egypt.
Country #3 is the United Kingdom.
Country #4 is the United States.

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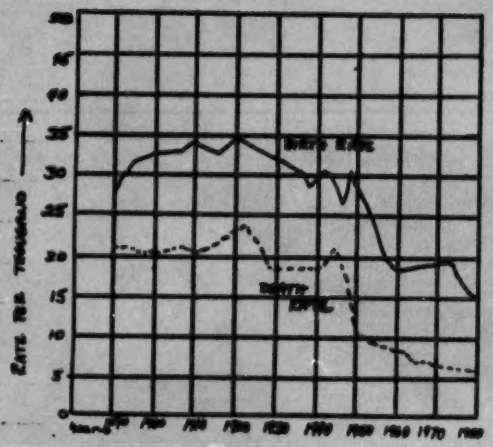
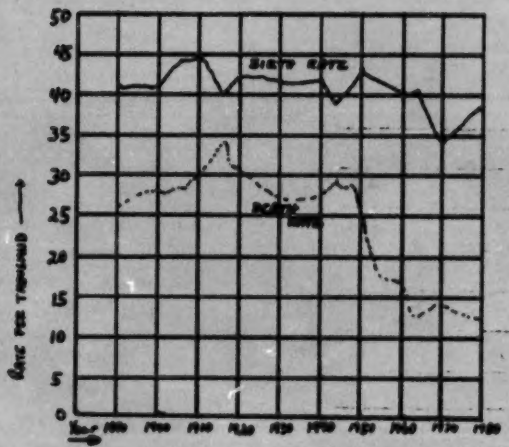
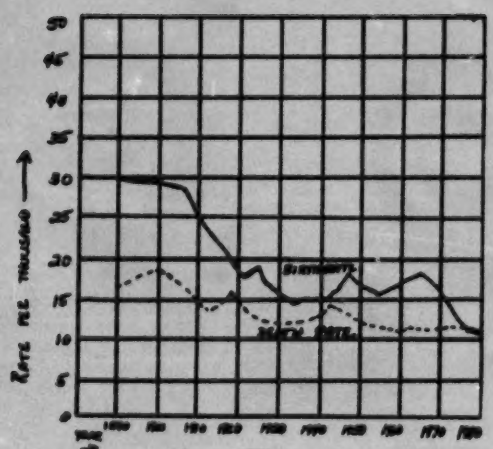
BIRTH RATES AND DEATH RATES



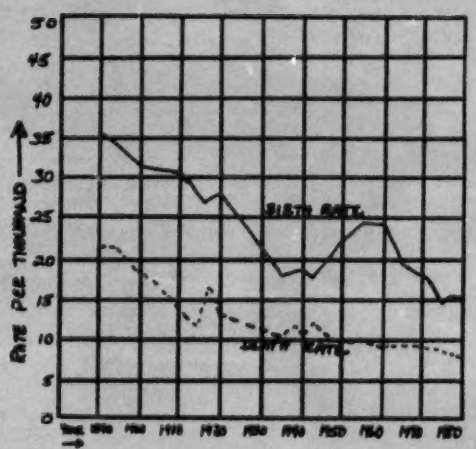
COUNTRY 1



Country 2



COUNTRY 3



COUNTRY 4

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Title: WORLD POPULATION DATA SHEET*

Introduction:

The usefulness of data depends largely on the questions posed that concern the data. In the following exercise, the same data can be analyzed and examined in 34 different ways, documenting the use of population growth data.

Objectives:

To familiarize students with data on population growth and economic development.

To encourage students to use the data by listing and comparing data.

To encourage students to recognize the many uses of data in examining population dynamics.

Grade Level: 7-12

Time: One class period. The time will vary, depending on the number of activities planned.

Materials: You will need copies of the World Population Data Sheets. You can duplicate the 1980 data included with this activity or order large wall-size copies of the Data Sheet from the Population Reference Bureau, Inc., P.O. Box 35012, Washington, DC 20013. Request the current copy of the World Population Data Sheet. The larger charts will have more impact with students, and it may be necessary to get only one chart for each five or six students. You will also need to duplicate the "ideas" handout if the students are going to indicate their own choices of activities to complete.

Procedure:

1. Hand out the chart. Ask students to locate the five largest countries in the world. Explain how to read the chart and what the categories represent. This information is provided in the general notes on the chart.

2. Either identify some of the 34 activities and assign them to the students, or allow them to make their own choices or preferences.

*Many of the suggestions for using the data come from ideas generated by teachers at a University of Denver High School Conference on Food and Population.

Evaluation:

Discuss the results of each group's work, using any one of the following formats:

1. Have students report what information was learned by completing the statement, "I learned that _____."
2. Ask students to decide which of the activities provided them with the most new information. Share ideas with the entire group.
3. Have students explain how data are insufficient for grasping the entire picture of an issue. Which activity that was performed indicated this consideration the most vividly? Why?

IDEAS FOR USE OF WORLD POPULATION DATA SHEET

1. Hang it up and let students tell you what to do with it.

2. Shade (color) the world map according to birth and death rates, or any other data on the chart.

3. Given x amount of dollars, have students decide which country to aid and give reasons why based on the data sheet.

4. Why are there no statistics in certain columns?

5. List the 10 countries that have the highest and the 10 countries with the lowest growth rates. In groups, investigate cultural factors affecting this growth rate.

6. Middle East -- What does the information tell you about the present situation?

7. Relate figures to environmental factors, colonial background, energy consumption, dominant religion, etc.

8. By using the chart, students will be able to make a hypothesis about the relationship of population growth to per capita gross national product.

9. Students could take information from the chart and transform it to a graph.

10. Which countries will double in population first? Last?

11. Which geographic region has the most people now? Which will have the most in 1990?

12. Have students figure out five or ten ways in which they can categorize the data they have. For example, the places I would not want to live in; the places that are like the United States.

13. Can you identify the "developing" nations? What factors do you use to identify them?

14. Politically, where are the most populous countries? Economically? Culturally?

15. Are there any countries that have reached or are fast approaching zero population growth? Reasons?

16. Find the "worst" place in the world to live. The "best" place.

17. Using the data, write a one-page definition of the population "problem" that the world is facing.

18. Choose one country. Describe the quality of life there, using information from a journal, short story, poem, cartoon, or drawing.

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19. Find descriptive pictures of one country that show some of its statistical data.

20. Relationship of population numbers or GNP to physical size of a country.

21. Space activity
    -- multiply people by birth rate and have students interact with the results
    -- first students occupy the total space in the room
    -- then with new statistics decrease space likewise to accommodate new statistics
    -- continue to decrease space by increasing population in terms of future population projections
    -- ask students feelings on continued population/space relationship -- problems and prospects

22. From data on the sheet, write a paper proving a certain point. Then, take the oppostie point of view and prove it from the data on the sheet.

23. For countries, find out the average per capita income of the "haves" and the "have nots."

24. Which countries would food aid help the most?

25. Is there any relationship between the population growth of a country and its form of government?

26. By using a graph, make a comparison between any two factors you choose.

27. Number of years to double populations -- activity designed to find out how many countries of the world will have doubled their population by the time the student is 30 years old, 40, 50, or 75.

28. Simulation idea -- population or food conference using sections of the world or key countries. Every 10 minutes = 1 year. Compute changes in figures if no agreement is reached on population control measures. Goal is to sense pressures to come to some decision.

29. Identify a place you'd like to live in other than the United States, using data to describe the life you might have there. How would you view the United States from the country you choose?

30. Choose five or six regions. Have groups of students examine the data sheet and describe national priorities as if they are the political leaders of that country.

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31. You are pregnant, live in the following cities, and can buy an airplane ticket with your per capita gross national product ($1 goes 2 miles). From each city, where can you go to increase your child's life expectancy the most?

Brasilia, Brazil
Peking, China
Calcutta, India
Kabul, Afghanistan
Niwot, Colorado

32. What information is included on the Data Sheet that is not included in an almanac covering the same countries?

33. Write to the Bureau of Census to get the figures that would belong in each column for your state (Colorado, New Mexico, etc.).

34. Donut activity

1. From an almanac, cut out all the colored flags for each nation. (You will need two almanacs to get all flags.) Place a number on the back to help you identify the country.

2. Don't explain anything about the exercise. Tell the students to pick any flag. (Teacher usually "pulls" U.S. for self.)

3. Student registers nation, is given population and rate of growth (<u>not</u> per capita income). They are assigned the task of getting certain information about the nation, then predicting what the future of the nation is.

4. Teacher (later that day) records per capita income for each nation, then totals all P.C.I. Buy <u>one</u> <u>donut</u> for <u>each</u> $1,000 P.C.I.

   (Example: $24,000 = 24.6 or 25 donuts)

5. Next day, seat students by continent. Call each student forward, tell him of 1 donut per $1,000, then give him his "share" of the world's wealth (e.g. $120 gets 1/8 donut). A variation is to use "high quality" donuts for the U.S. and Europe, "medium quality" for some other ($500-$2,000 P.C.I.), and "plain donuts" for underdeveloped nations.

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ESTIMATING POPULATION OF WORLD AND INDIVIDUAL COUNTRIES

In general, midyear population estimates are derived from midyear Government or United Nations' estimates for the preceding year. Those estimates are applied to the current year by applying what is considered to be an appropriate growth rate for the one-year period. In most instances the growth rate used is that experienced in previous one- or two-year periods, or that implied by U.N. population projections.

Use of other methods usually results in different figures. One generally accepted method is to project the separate components of population change; that is, to apply fertility, mortality, and international migration assumptions to the latest age-sex distribution--usually data derived from the latest census. Such longer range projections may vary from the one-year projections presented here because of two principal factors: (1) whether or not the Government or United Nations population estimates are accepted as valid; and (2) whether or not the preceding year estimates or the base data for the projections take undernumeration into account; i.e., the population totals are increased on the basis of knowledge regarding the degree to which the latest census undernumerated the population. Also, differences in timing and other factors may result in estimates which differ from those officially accepted by the various countries.

It is not known whether the estimates presented here are closer to the actual populations in the various countries than those which would result from the longer range component projections or from other projection techniques, particularly those based on adjusted totals and age-sex distributions. It would be fortuitous if any estimate now were to prove identical with the final official figure when the latter is known, but it is believed that the estimates given here by the Population Reference Bureau are technically sound, although differing in some cases with estimates from other sources.

Adapted from:
World Population Growth and Response: 1965-1975, A Decade of Global Action (Washington, DC: Population Reference Bureau, 1976) pp. 246-270.

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Zero Population Growth

Since its establishment in 1968, Zero Population Growth, Inc. (ZPG) has conducted and supported programs of education and information "stressing the need for achieving zero population growth in the United States and elsewhere as soon as possible." By mid-1975, ZPG had a nationwide membership of about 10,000 and a network of 100 chapters. It is the only registered national population lobby.

In the spring of 1975, the organization reaffirmed its long-standing interests in promoting small families, improving birth control options, preserving the right to select abortion, and reducing immigration to the United States. At the same time, it has stepped up attention to population distribution and per capita consumption of natural resources. ZPG is currently giving detailed consideration to the possible components of a comprehensive U.S. policy on population size and distribution.

Combining these new initiatives with traditional concerns, ZPG is presently working to foster public attitudes supportive of small families, child-free couples, fertility control, population stabilization, provision of fertility control services to all persons, reduction in levels of teen-age pregnancy, U.S. assistance for fertility-control programs in other nations and for stabilization of the world population. ZPG is also working to lower levels of per capita resource consumption in the United States and to stimulate stewardship of U.S. land resources and desired policies in growth-determinant fields such as transportation and other public facilities.

ZPG assigns top priority to educational work with public officials and to broad public education on population matters through news media, its newsletter, special studies and reports, and work with a special correspondence group.

Its school-oriented role is one of encouraging school systems at regional and State levels to apply modern population education concepts. Heavily involved in past years with the development of population education materials and curricula for use on the Nation's schools, ZPG has recently decided that it should now concentrate on the implementation of such materials and curricula.

Note: *It is recognized that, in addition to the organizations discussed above, scores of other institutions and organizations in the United States and elsewhere throughout the world also have given attention to population matters during the 1965-75 decade. The above descriptions cover the most significant of such activities for which information has been available to the Population Reference Bureau. Of special note have been the activities of many U.S. universities and colleges in the area of population studies and technical assistance. A number of foreign organizations and foundations, including the Colombo Plan, also have rendered valuable assistance to population programs during the decade.*

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World Population Data—1965 and 1975 Compared

Region	Estimated population, July 1		Births per 1,000 population		Deaths per 1,000 population		Rate of natural increase		Time to double population[1]		GNP per capita[3]	
	1965	1975	1965	1974[2]	1965	1974[2]	1965	1974[2]	1965	1974[2]	1965	1973
	Thousands	*Thousands*	*Number*	*Number*	*Number*	*Number*	*Percent*	*Percent*	*Years*	*Years*	*Dollars*	*Dollars*
World	3,289,308	3,947,039	34	30	15	12	1.9	1.8	36	38	920	1,250
Northern America	214,073	236,552	20	15	9	9	[4]1.0	0.6	69	116	4,950	6,130
Latin America	241,078	317,083	39	37	11	9	2.8	2.8	25	25	590	770
Mainland	218,998	290,271	39	38	11	9	2.8	2.9	25	24	590	770
Caribbean Islands	22,080	26,812	36	31	10	9	2.6	2.2	27	32	560	780
Europe[5]	666,604	718,682	18	16	9	10	0.9	0.6	77	116	1,900	3,010
Africa[6]	278,176	365,003	48	47	23	21	2.5	2.6	28	27	250	310
Near East[7]	126,270	163,536	42	41	16	14	2.6	[4]2.6	27	27	470	710
South Asia	635,210	799,886	44	38	20	16	2.4	2.2	29	32	110	120
South East Asia	247,911	319,281	44	38	18	15	2.6	[4]2.4	27	29	140	180
East Asia	862,433	1,005,787	33	26	15	9	1.8	1.7	38	41	350	680
Oceania	17,553	21,229	24	22	10	10	1.4	1.2	50	58	2,660	3,300

[1] Based on the rate of natural increase shown and assuming no change in the rate.

[2] Data refer to 1973, 1974, or to the 1970-75 period.

[3] For the Communist countries and for nearly all countries with populations of less than 1 million, the estimates were derived by applying the annual growth rate for the 1965-72 period to the 1972 estimate. The figures were published in the 1974 edition of the *World Bank Atlas: Population, Per Capita Product and Growth Rates*. The 1972 estimates are in market prices and are based on a multiyear period (1965-71) to convert domestic currencies to dollars. For the remaining countries, the figures are in 1973 constant dollar equivalents.

[4] Difference due to rounding of birth and death rates.

[5] Excludes Greece, shown in Near East section of World Population Data, page 269, and includes over 60 million in Asiatic U.S.S.R. See text.

[6] Excludes population of Egypt, shown in Near East section of *World Population Data*, page 269. See text.

[7] Excluding Greece as European, 1975 total for Near East as 117.3 million.

Note: For general sources and methods, see the notes of the table **World Population Data.** The estimates given above are the weighted averages for the countries within each region for which data are available or estimates were derived.

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WORLD POPULATION DATA 1980

Region or Country[1]	Population Estimate Mid-1980 (millions)[2]	Birth Rate[3]	Death Rate[3]	Rate of Natural Increase (annual, %)[3]	Number of Years to Double Population[3]	Population Projected for 2000 (millions)[4]	Infant Mortality Rate[5]	Total Fertility Rate[5]	Population under Age 15 (%)[5]	Population over Age 64 (%)[5]	Life Expectancy at Birth (years)[5]	Urban Population (%)[6]	Projected Ultimate Population Size (millions)[7]	Per Capita Gross National Product (US$)[8]
WORLD	4,414	28	11	1.7	41	6,156	97	3.5	35	6	61	39	9,832	2,690
MORE DEVELOPED[1]	1,131	16	9	0.6	111	1,272	20	2.0	24	11	72	69	1,272	6,300
LESS DEVELOPED[1]	3,283	32	12	2.0	34	4,884	119	4.4	39	4	57	29	8,460	530
AFRICA	472	46	17	2.9	24	802	140	6.6	46	3	49	25	2,861	530
NORTHERN AFRICA	130	42	13	2.8	25	205	121	6.2	44	3	54	42	370	790
Algeria	19.0	48	13	3.4	20	36.9	142	7.3	47	4	53	55	93.6	1,260
Egypt	42.1	38	10	2.7	26	64.9	90	5.3	40	4	55	44	98.0	480
Libya	3.0	47	13	3.5	20	5.7	130	7.4	49	4	55	60	11.7	6,910
Morocco	21.0	43	14	3.0	23	37.3	133	6.9	46	2	55	42	78.9	670
Sudan	18.7	49	18	3.1	22	31.8	141	6.6	44	3	46	28	68.8	320
Tunisia	6.5	33	8	2.5	28	9.7	125	5.7	44	4	57	50	14.4	950
WESTERN AFRICA	141	49	19	3.0	23	302	159	6.8	46	3	46	21	711	440
Benin	3.6	48	19	3.0	23	6.6	149	6.7	46	4	46	14	15.0	230
Cape Verde	0.3	28	9	1.8	38	0.4	105	3.8	36	4	60	20	0.6	180
Gambia	0.6	48	25	2.4	28	1.0	217	6.4	41	2	41	16	2.4	230
Ghana	11.7	48	17	3.1	22	21.2	115	6.7	47	3	48	36	56.6	380
Guinea	5.0	46	21	2.5	27	8.2	175	6.2	44	3	44	23	22.6	210
Guinea-Bissau	0.6	41	23	1.8	38	0.9	200	5.5	39	4	41	28	1.7	200
Ivory Coast	8.0	48	18	2.9	24	14.8	154	6.7	46	2	46	32	38.1	840
Liberia	1.9	50	17	3.2	21	3.5	146	6.7	48	2	46	29	8.6	480
Mali	6.6	49	22	2.7	26	11.6	190	6.7	46	1	38	17	27.9	120
Mauritania	1.6	50	22	2.8	25	2.9	187	6.9	42	6	42	23	7.2	270
Niger	5.5	51	22	2.9	24	10.0	200	7.1	47	3	42	11	23.7	220
Nigeria	77.1	50	18	3.2	22	148.9	157	6.9	47	2	46	20	434.7	580
Senegal	5.7	48	22	2.6	27	9.7	160	6.5	44	3	42	32	23.5	340
Sierra Leone	3.5	46	19	2.6	26	6.6	136	6.4	41	5	46	16	13.6	210
Togo	2.5	48	19	3.0	23	4.7	163	6.7	46	3	46	15	11.9	320
Upper Volta	6.9	46	22	2.6	27	11.8	182	6.5	44	3	42	5	24.2	160
EASTERN AFRICA	135	46	19	3.0	23	204	122	6.6	46	3	47	13	629	340
Burundi	4.5	47	20	2.7	25	7.8	140	6.3	44	2	42	5	19.9	140
Comoros	0.3	48	18	2.2	31	0.4	148	5.2	43	3	46	11	1.4	180
Djibouti	0.4	48	24	2.5	28	0.6	–	–	–	–	–	70	–	450
Ethiopia	32.6	50	25	2.5	28	55.3	162	6.7	45	3	38	13	136.5	120
Kenya	15.9	53	14	3.9	18	32.3	83	8.1	50	2	56	18	93.8	320
Madagascar	8.7	46	19	2.6	27	15.1	102	6.1	43	3	46	16	39.1	250
Malawi	6.1	51	29	2.2	32	11.5	142	7.0	44	4	46	9	31.3	180
Mauritius	0.9	27	7	2.0	34	1.3	35	3.1	37	4	67	44	1.8	830
Mozambique	10.3	45	19	2.6	27	17.9	148	6.1	45	2	46	8	44.0	140
Reunion	0.5	26	6	1.9	36	0.7	41	2.8	38	4	65	56	1.2	3,060
Rwanda	5.1	50	19	3.0	23	9.6	127	6.9	47	3	46	4	24.7	180
Seychelles	0.1	26	6	1.8	38	0.1	43	4.5	42	6	65	37	–	1,000
Somalia	3.6	48	20	2.8	25	6.3	177	6.1	44	2	43	31	17.0	130
S. Rhodesia (Zimbabwe)	7.4	47	14	3.4	21	14.0	129	6.5	47	3	54	20	37.2	480
Tanzania	18.6	47	16	3.1	22	35.0	125	6.5	46	3	50	13	93.9	230
Uganda	13.7	45	14	3.0	23	25.5	120	6.1	45	3	52	7	57.9	–
Zambia	5.8	48	17	3.2	22	10.7	144	6.9	46	3	48	30	28.6	480
MIDDLE AFRICA	54	46	20	2.6	27	87	167	6.8	43	3	46	29	218	380
Angola	6.7	48	23	2.6	28	11.2	203	6.4	44	3	41	22	29.2	380
Cameroon	8.5	42	19	2.3	30	13.1	157	5.7	41	4	44	29	31.5	460
Central African Rep.	2.2	42	19	2.2	31	3.6	190	5.5	41	4	42	42	8.3	250

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Region or Country*	Population Estimate Mid-1980 (millions)*	Birth Rate*	Death Rate*	Rate of Natural Increase (annual, %)*	Number of Years to Double Population*	Population Projected for 2000 (millions)*	Infant Mortality Rate*	Total Fertility Rate*	Population under Age 15 (%)	Population over Age 64 (%)	Life Expectancy at Birth (years)*	Urban Population (%)**	Projected Ultimate Population Size (millions)**	Per Capita Gross National Product (1980)**
Chad	4.5	44	21	2.3	30	7.4	165	5.9	42	4	44	18	17.4	140
Congo	1.6	45	19	2.6	27	2.5	150	6.0	43	3	46	39	6.9	540
Equatorial Guinea	0.4	42	19	2.3	30	0.6	165	5.7	42	4	46	51	1.2	
Gabon	0.6	33	22	1.1	62	0.8	170	4.3	33	6	44	32	1.3	3,580
Sao Tome and Principe	0.1	46	11	3.4	21	0.1	84	–	–	–	–	24	–	400
Zaire	29.3	45	19	2.8	25	48.1	150	6.1	45	3	46	30	121.9	210
SOUTHERN AFRICA	32	39	11	2.8	25	52	97	5.2	42	4	50	44	126	1,300
Botswana	0.8	51	17	3.4	21	1.4	99	6.5	50	3	56	12	4.5	620
Lesotho	1.3	40	16	2.4	29	2.1	111	5.4	40	4	50	6	5.1	280
Namibia	1.0	44	15	2.9	24	1.7	142	5.9	44	3	51	32	4.5	1,000
South Africa	28.4	36	10	2.8	25	48.3	97	5.1	42	4	60	48	107.5	1,480
Swaziland	0.6	47	19	2.8	25	0.9	160	6.4	46	3	46	6	2.7	590
LATIN AMERICA	360	34	8	2.6	26	598	85	4.5	42	4	64	61	985	1,300
MIDDLE AMERICA	91	38	7	3.1	22	168	72	5.3	46	3	64	59	274	1,180
Costa Rica	2.2	31	4	2.7	26	3.4	28	3.8	44	4	70	41	4.7	1,540
El Salvador	4.8	40	7	3.3	21	8.6	91	6.0	46	3	62	39	13.7	660
Guatemala	7.8	43	12	3.1	23	12.3	76	5.7	45	3	58	36	23.2	910
Honduras	3.8	47	12	3.5	20	7.1	103	7.1	48	3	57	31	15.3	600
Mexico	68.2	37	6	3.1	22	128.9	70	5.2	46	3	65	66	260.5	1,290
Nicaragua	2.6	47	12	3.6	20	4.8	122	6.6	48	3	55	49	9.3	840
Panama	1.9	28	6	2.2	31	2.9	47	4.1	44	4	70	51	4.5	1,290
CARIBBEAN	20	25	8	1.9	36	42	72	3.8	40	5	68	59	66	1,300
Bahamas	0.2	25	5	2.0	34	0.3	25	3.5	44	4	69	58	0.4	2,630
Barbados	0.3	16	8	0.9	80	0.3	27	2.2	32	10	70	44	0.4	1,940
Cuba	10.0	18	6	1.2	58	12.7	25	2.5	37	8	72	64	16.5	810
Dominica	0.1	21	5	1.6	43	0.1	20	–	–	–	58	27	–	440
Dominican Republic	5.4	37	9	2.8	25	8.5	96	5.4	46	3	60	49	15.1	910
Grenada	0.1	27	6	2.2	32	0.1	24	–	–	–	63	15	0.2	530
Guadeloupe	0.3	17	6	1.1	65	0.4	25	2.2	32	8	69	46	–	2,850
Haiti	5.0	42	16	2.6	26	9.9	130	5.9	41	4	51	24	16.3	280
Jamaica	2.2	29	7	2.2	31	2.8	15	3.7	46	6	70	41	5.3	1,110
Martinique	0.3	16	7	0.9	80	0.4	32	3.0	32	6	69	50	–	3,950
Netherland Antilles	0.3	28	7	2.2	32	0.4	25	3.1	38	6	62	48	–	3,150
Puerto Rico	3.5	23	6	1.7	42	4.5	20	2.4	36	6	73	62	–	2,720
St. Lucia	0.1	35	7	2.8	25	0.1	36	–	50	5	67	17	–	630
Trinidad and Tobago	1.2	25	6	1.9	37	1.4	29	2.6	38	4	67	49	2.2	2,910
TROPICAL SOUTH AMERICA	198	36	9	2.7	26	333	90	4.6	42	3	62	60	561	1,430
Bolivia	5.3	44	19	2.5	28	8.9	168	6.8	42	4	47	34	19.4	510
Brazil	122.0	36	8	2.8	25	206.1	100	4.4	41	3	64	61	341.0	1,570
Colombia	26.7	29	8	2.1	33	42.2	77	3.9	46	3	62	60	56.2	870
Ecuador	8.0	42	10	3.1	22	14.6	78	6.3	44	4	60	43	25.7	910
Guyana	0.9	28	7	2.1	33	1.2	58	3.9	40	4	68	40	2.0	550
Paraguay	3.3	39	8	3.1	22	5.6	64	5.8	45	3	64	40	9.2	850
Peru	17.6	40	12	2.8	25	29.2	92	5.3	44	3	58	62	54.6	740
Suriname	0.4	30	7	2.3	30	0.7	30	–	46	4	67	66	1.8	2,110
Venezuela	13.9	36	6	3.0	23	25.7	45	4.9	43	3	66	75	48.1	2,910
TEMPERATE SOUTH AMERICA	41	20	9	1.5	46	54	44	2.9	30	7	68	80	84	1,790
Argentina	27.1	26	9	1.6	43	32.9	45	2.9	28	8	68	80	41.0	1,910
Chile	11.3	21	7	1.4	48	15.2	48	3.0	35	5	66	80	18.6	1,410
Uruguay	2.9	21	10	1.1	65	3.5	46	2.7	27	10	69	83	4.5	1,610

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Region or Country[1]	Population Estimate Mid-1980 (millions)[2]	Birth Rate[3]	Death Rate[3]	Rate of Natural Increase (annual, %)[3]	Number of Years to Double Population[3]	Population Projected for 2000 (millions)[4]	Infant Mortality Rate[3]	Total Fertility Rate[3]	Population under Age 15 (%)	Population over Age 64 (%)	Life Expectancy at Birth (years)[3]	Urban Population (%)[5]	Projected Ultimate Population Size (millions)[6]	Per Capita Gross National Product (US$)[7]
ASIA	2,569	28	11	1.6	39	3,570	108	3.9	37	4	58	27	5,572	780
SOUTHWEST ASIA	98	40	12	2.7	25	164	133	6.8	48	4	58	46	281	2,330
Bahrain	0.4	44	9	3.6	20	0.7	78	7.4	44	3	63	78	1.1	4,100
Cyprus	0.6	19	8	1.1	64	0.7	17	2.1	25	10	73	53	1.0	2,110
Gaza	0.4	53	18	3.5	20	0.7	137	–	48	5	52	57	–	–
Iran	13.2	47	13	3.4	20	24.5	104	7.0	48	4	55	66	48.1	1,880
Israel	3.9	25	7	1.8	38	5.5	15	3.5	33	8	73	87	7.5	4,120
Jordan	3.2	46	13	3.3	21	5.9	97	7.0	48	3	56	42	11.8	1,800
Kuwait	1.3	42	5	3.7	19	3.1	30	7.0	44	2	70	58	5.3	14,800
Lebanon	3.2	34	10	2.5	28	4.9	60	4.7	43	5	65	68	7.6	–
Oman	0.9	48	19	3.0	23	1.7	142	7.2	45	3	47	9	3.2	2,570
Qatar	0.2	44	14	3.0	23	0.4	138	7.2	45	3	46	80	0.8	12,740
Saudi Arabia	8.2	48	18	3.0	23	15.5	150	7.2	45	3	48	24	36.8	6,040
Syria	8.6	45	13	3.2	21	16.2	114	7.4	48	4	57	48	32.7	930
Turkey	45.5	36	10	2.5	28	68.6	119	5.0	40	4	58	45	97.8	1,210
United Arab Emirates	0.8	44	14	3.0	23	1.6	138	7.2	34	3	68	85	2.5	14,230
Yemen, North	5.6	48	25	2.3	30	9.5	180	6.8	47	4	45	11	26.4	500
Yemen, South	1.9	46	21	2.7	26	3.4	136	7.0	48	4	45	33	8.9	420
MIDDLE SOUTH ASIA	986	37	16	2.2	32	1,422	137	5.5	42	3	51	21	2,596	180
Afghanistan	15.9	48	21	2.7	26	26.4	226	6.9	45	3	37	11	66.8	240
Bangladesh	90.6	46	20	2.6	27	156.7	153	6.3	44	3	46	9	334.5	90
Bhutan	1.3	43	21	2.2	31	2.0	147	6.2	42	3	43	4	4.0	100
India	676.2	34	15	1.9	36	970.2	134	5.3	41	3	52	21	1,642.8	180
Iran	38.5	44	14	3.0	23	66.1	112	6.3	44	4	58	47	101.0	–
Maldives	0.1	50	23	2.7	26	0.2	119	–	44	2	–	11	–	150
Nepal	14.0	44	20	2.4	29	22.0	133	6.4	46	3	43	4	51.4	120
Pakistan	85.5	44	16	2.8	25	152.0	142	6.3	46	3	52	26	334.6	230
Sri Lanka	14.8	28	7	2.2	32	20.0	42	3.4	39	4	63	22	30.3	190
SOUTHEAST ASIA	364	36	13	2.2	31	539	96	4.7	42	3	53	21	925	400
Brunei	0.2	28	4	2.4	29	0.3	20	5.1	43	3	66	64	–	18,640
Burma	34.4	30	14	2.4	29	53.7	140	5.5	40	4	52	24	92.3	150
Dem. Kampuchea	8.0	33	15	1.8	39	9.1	150	4.7	42	3	44	12	36.5	–
East Timor	0.8	44	21	2.3	30	1.1	175	6.1	42	3	42	12	–	–
Indonesia	144.3	35	15	2.0	34	210.6	91	4.1	42	2	50	18	356.8	360
Laos	3.7	44	20	2.4	29	5.7	175	6.2	42	3	39	15	11.1	90
Malaysia	14.0	31	6	2.5	28	20.7	44	4.4	41	3	61	27	29.5	1,690
Philippines	47.7	34	10	2.4	28	78.1	80	5.0	43	3	61	32	127.9	510
Singapore	2.4	17	5	1.2	58	3.0	12	1.9	31	4	71	100	3.7	5,290
Thailand	47.3	32	9	2.3	30	75.5	66	4.5	43	3	60	13	104.7	690
Vietnam	53.3	41	18	2.3	30	80.9	115	5.8	41	4	48	19	149.4	170
EAST ASIA	1,373	18	6	1.2	57	1,683	31	2.3	31	6	65	32	1,812	1,290
China[8]	979	18	6	1.2	58	1,212.3	56	2.3	32	6	64	26	1,530.0	460
Hong Kong	4.8	18	5	1.2	56	6.2	12	2.6	29	6	72	92	7.3	3,940
Japan	116.8	15	6	0.9	79	129.4	8	1.8	24	8	75	76	133.4	7,330
Korea, North	17.9	33	8	2.4	28	27.4	70	4.5	40	4	62	53	42.9	730
Korea, South	38.2	23	7	1.6	44	51.1	38	3.2	38	4	62	48	64.1	1,160
Macao	0.3	30	8	2.2	32	0.3	78	–	36	5	–	97	–	1,460
Mongolia	1.7	37	9	2.9	24	2.7	70	5.3	43	3	62	47	3.9	940
Taiwan	17.8	25	5	2.0	35	23.8	25	3.1	35	4	71	77	29.6	1,400

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Region or Country[1]	Population Estimate Mid-1980 (millions)[2]	Birth Rate[3]	Death Rate[3]	Rate of Natural Increase (annual, %)[3]	Number of Years to Double Population[4]	Population Projected for 2000 (millions)[5]	Infant Mortality Rate[3]	Total Fertility Rate[3]	Population under Age 15 (%)	Population over Age 64 (%)	Life Expectancy at Birth (years)[3]	Urban Population (%)[6]	Projected Urban Population Size (millions)[6]	Per Capita Gross National Product (US$)[7]
OCEANIA	25	20	9	1.1	61	30	42	2.8	31	8	69	71	27	8,000
Australia	14.6	16	8	0.8	86	17.9	12	2.1	27	9	73	86	14.5	7,920
Fiji	0.6	27	4	2.3	30	0.8	41	4.0	41	2	71	37	1.2	1,440
New Zealand	3.2	16	8	0.8	83	3.9	14	2.2	29	9	72	83	4.6	4,790
Papua New Guinea	3.2	41	16	2.5	27	5.1	106	6.0	44	4	50	13	0.3	560
Samoa, Western	0.2	37	7	3.0	23	0.2	40	5.8	50	3	63	21	0.5	–
Solomon Islands	0.2	41	10	3.1	22	0.4	78	6.2	44	3	57	9	–	430
EUROPE	486	14	10	0.4	170	521	19	2.0	26	12	72	68	580	5,000
NORTHERN EUROPE	82	13	11	0.1	476	84	13	1.8	23	14	72	76	99	6,140
Denmark	5.1	12	10	0.2	385	5.3	9	1.7	22	14	74	67	5.4	9,920
Finland	4.8	14	9	0.4	161	5.1	9	1.7	22	11	72	58	5.2	6,820
Iceland	0.2	19	6	1.2	57	0.3	11	2.3	30	9	76	87	0.3	9 320
Ireland	3.3	22	10	1.1	61	4.0	16	3.4	31	11	71	52	5.5	[illegible]
Norway	4.1	13	10	0.3	248	4.4	9	1.8	24	14	76	66	4.5	9,510
Sweden	8.3	1[illegible]	11	0.0	1,386	8.6	8	1.7	21	15	75	83	8.2	10,210
United Kingdom	56.0	12	12	0.1	1,195	56.5	14	1.7	23	14	72	78	60.1	5,030
WESTERN EUROPE	253	12	11	0.1	910	259	12	1.6	22	14	72	82	263	8,570
Austria	7.5	11	12	-0.1	–	7.6	15	1.6	23	15	72	52	7.8	7,830
Belgium	9.9	12	12	0.1	990	10.7	12	1.7	22	14	71	95	10.4	9,670
France	53.8	14	10	0.3	198	57.5	11	1.9	24	14	73	73	60.7	8,270
Germany, West	61.1	9	12	-0.2	–	58.8	15	1.4	21	15	72	92	60.8	9,000
Luxembourg	0.4	11	12	-0.0	–	0.4	11	1.5	20	13	70	68	0.4	10,410
Netherlands	14.1	13	8	0.4	198	15.5	10	1.6	25	11	75	88	15.8	8,390
Switzerland	6.3	11	9	0.2	301	6.4	10	1.5	22	13	73	55	6.8	12,100
EASTERN EUROPE	110	15	11	0.7	102	121	23	2.3	23	11	71	50	126	3,670
Bulgaria	8.9	16	10	0.5	139	9.5	22	2.3	22	11	71	60	10.4	3,200
Czechoslovakia	15.4	18	12	0.7	100	17.2	19	2.4	23	12	70	67	19.0	4,720
Germany, East	16.7	14	14	0.0	–	16.6	13	1.8	21	16	72	76	17.7	5,000
Hungary	10.8	16	13	0.3	267	11.2	24	2.2	21	13	70	52	11.8	3,450
Poland	35.5	19	9	1.0	71	40.9	22	2.3	24	10	71	57	46.8	3,660
Romania	22.3	20	10	1.0	69	25.7	31	2.6	25	10	70	48	29.7	1,750
SOUTHERN EUROPE	140	15	9	0.7	105	157	24	2.3	26	11	71	60	172	3,290
Albania	2.7	30	8	2.2	32	3.8	87	4.2	37	5	68	34	5.7	740
Greece	9.6	16	9	0.7	98	10.6	19	2.3	24	12	73	65	10.9	3,270
Italy	57.2	12	9	0.3	224	61.3	18	1.9	24	12	72	67	62.6	3,840
Malta	0.3	17	10	0.8	92	0.4	16	2.0	25	9	71	94	0.4	2,160
Portugal	9.9	17	10	0.7	99	11.6	30	2.5	28	10	68	29	13.6	2,020
Spain	37.8	17	8	0.9	75	43.9	16	2.6	28	10	72	70	50.0	3,520
Yugoslavia	22.4	17	9	0.9	80	25.7	34	2.2	26	9	68	39	28.6	2,390
USSR	265	18	10	0.8	82	311	31	2.4	24	10	70	62	360	3,700
NORTH AMERICA	247	16	8	0.7	98	289	13	1.8	23	11	73	74	296	9,894
Canada	24.0	15	7	0.8	88	29.0	12	1.9	26	8	73	76	30.3	9,170
United States	222.5	16	9	0.7	99	260.4	13	1.8	22	11	73	74	265.5	9,700

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General Notes

World Population Data Sheets of various years should not be used as a time series. Because every attempt is made to use the most recent and most accurate information, data sources vary and changes in numbers and rates from year to year may reflect improved source material, revised data, or a later base year for computation, rather than yearly changes.

Sources of data: Aside from population estimates and projections (see footnotes 2 and 6), number of years to double population (footnote 5), and per capita Gross National Product (footnote 12), most of the data in this *Data Sheet* were reported in the following United Nations (UN) publications: *Demographic Yearbook, 1977 and 1978; Population and Vital Statistics Report, Data Available as of 1 January 1980,* Statistical Papers, Series A, Vol. XXXII, No. 1; and *World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment,* ST/ESA/SER.R/33, 1979. Other sources were: U.S. Bureau of the Census, *World Population: 1977, 1978,* and *World Population: 1979* (forthcoming); unpublished reports of the Census Bureau's Foreign Demographic Analysis Division; World Bank, *Population Projections 1975-2000 and Long-term (Stationary Population),* prepared by K. C. Zachariah and My Thi Vu of the Bank's Population and Human Resources Division, July 1979; Country Reports of the World Fertility Survey; official country publications; and special studies.

Figures for the regions and the world: Population totals (columns 1 and 6) take into account small areas not listed on the *Data Sheet.* These totals may also not equal the sums of their parts because of independent rounding. All other regional and world figures are weighted averages for countries for which data are available.

Footnotes

[1]The *Data Sheet* lists all geopolitical entities with a population larger than 200,000 and all members of the United Nations (UN) regardless of population size. Classification of "more developed" and "less developed" regions follows the latest (1979) practice of the UN. The "more developed" regions comprise all of Europe, North America (Canada and the United States), Australia, New Zealand, Japan, and the USSR. Cyprus, Israel, and Turkey, formerly included in the "more developed" region of Southern Europe, are now included by the UN with their region of location, Southwest Asia, and are thereby considered "less developed."

[2]Based on a population total from a very recent census or on the most recent official country or UN estimate; for almost all countries the estimate was for mid-1978. Each estimate was updated by the Population Reference Bureau to mid-1980 by applying the same rate of growth as indicated by population change during part or all of the period since 1970.

[3]Annual number of births or deaths per 1,000 population. For the more developed countries with complete or nearly complete registration of births and deaths, nearly all the rates shown pertain to 1977 or 1978. For most less developed countries with incomplete registration, the rates refer to the 1975-80 period. These rates were used in the medium variant estimates and projections as assessed by the UN in 1978 (UN, *World Population Trends and Prospects. . .*). These figures should be considered as rough approximations only. Some estimates were obtained from published reports of the U.S. Bureau of the Census, the World Bank, the World Fertility Survey, government statistical offices, and special studies.

[4]Birth rate minus the death rate. Since the rates were based on unrounded birth and death rates, some rates do not exactly equal the difference between the birth and death rates shown because of rounding.

[5]Based on the current *unrounded* rate of natural increase and assuming no change in the rate.

[6]For most countries, projected by the Population Reference Bureau by applying the 1980-2000 growth rate implied by the UN medium variant projections to the country's estimated mid-1980 population total. For the United States, the projection shown is from the most recent Series II projection published by the U.S. Bureau of the Census. This projection assumes that birth rates in the U.S. will rise somewhat during the balance of this century until a total fertility rate (see footnote 8) of 2.1 is reached.

[7]Annual number of deaths to infants under one year of age per 1,000 live births. For countries with complete or nearly complete registration of births and deaths, nearly all rates pertain to 1977 or 1978. For many less developed countries with incomplete registration, rates are the latest available estimates generally obtained from the sources noted above.

[8]The total fertility rate (TFR) indicates the average number of children that would be born to each woman in a population if each were to live through her childbearing lifetime (usually considered ages 15-49) bearing children at the same rate as women of those ages actually did in a given year. A TFR of 2.1 to 2.5, depending upon mortality conditions, indicates "replacement level" fertility—the level at which a country's population would eventually stop growing (or declining), leaving migration out of account. Most TFRs shown here refer to the 1975-80 period and are from UN, *World Population Trends and Prospects. . . .*

[9]Average number of years a newborn child could be expected to live if current mortality conditions were to continue throughout his or her lifetime. For the more developed countries with reliable mortality data, nearly all estimates shown pertain to part or all of the 1970-77 period. For most of the less developed countries with unreliable mortality data, estimates refer to some part of the period since 1970 and were prepared by one of the following organizations: the UN Population Division; the Population Division of the U.S. Bureau of the Census; or the World Bank's Population and Human Resources Division. Estimates of life expectancy for most less developed countries should be considered as rough approximations only.

[10]Percentage of total population living in areas termed urban by that country.

[11]This column has been included in this year's edition of the *Data Sheet* in order to illustrate each country's potential population growth and the ultimate size that could eventually be achieved. These projections were prepared by K. C. Zachariah and My Thi Vu of the World Bank *(Population Projections, 1975-2000 . . .)* and are not forecasts of what will necessarily happen, but could happen as a result of "long run implications of recent trends under a series of highly stylized assumptions." Specifically, the projections assume that fertility in all countries will someday arrive at replacement level (a TFR then of about 2.1) and remain there. For less developed countries, this is assumed to occur in the middle of the 21st century in Africa and somewhat earlier in Asia and Latin America. For more developed countries the arrival at replacement level fertility is placed about the year 2000. This assumes that the TFR will increase to 2.1 by that time in the many developed countries where fertility is now below replacement level. The projections also assume that immigration will have no appreciable impact on the population growth of a particular country; this assumption tends to lower the "ultimate population" of the United States and a few other countries which can be expected to receive immigrants in the future. Several regional totals were adjusted by the Population Reference Bureau in order to agree with the geographical classifications used on the *Data Sheet.*

[12]Data refer to 1978 and are provisional. All data for individual countries are from the World Bank, *World Bank Atlas: Population, Per Capita Product, and Growth Rates, 1979.*

[13]Opinions vary widely on demographic measures for China. Those shown here come from official sources quoted in the *Guangming Daily* and *People's Daily* and UN sources noted above. Their accuracy is unknown. The projected population for 2000 shown here could be high in light of China's recently announced policy to encourage the one-child family and reduce population growth to zero by 2000.

April 1980

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Title: HIDE AND SEEK: WHERE IS EVERYBODY?*

Introduction:

If students are talking about the world's population, they should know where, geographically speaking, the people are. People are not spread evenly around the earth's surface, and the density and distribution of human beings are important factors to consider when analyzing problems related to population growth. This activity has students make some guesses about population distribution. Then they must check their assumptions, using an atlas and map skills.

Objectives:

To complete the sequential worksheet on population distribution.

To generalize about the factors which determine where people live.

To become familiar with the uses of an atlas.

To gain knowledge about where people are located on the face of the earth.

Grade Level: 8-12

Time: One to two periods

Materials: Duplicate copies of the student handout, "Introduction to World Population Distribution." In addition, have a classroom or textbook atlas available for student use.

Procedure:

1. Ask the students, "Why do people seem to cluster in some places and not in others?" Write down their ideas on the board.

2. Hand out the worksheet to students. Allow enough time for them to answer the questions. Be sure an atlas or globe is handy.

3. Have students read some of their summary paragraphs. Did most of the students write similar statements?

*Adapted from an activity developed by Berry Beyer for Project Africa.

4. Having discovered where people cluster and some of the reasons for these patterns, have students consider this question: "Since people cluster in some areas and not in others, what are the implications for food supplies and distribution?" Answers to this question can be listed on the board and used as a basis for individual research.

Evaluation:

Give students two or three countries, mentioning three or four characteristics for each country which relate to the worksheet. Ask students to explain whether the population is sparse or dense and give reasons to support their views.

INTRODUCTION TO WORLD POPULATION DISTRIBUTION

Study Guide

1. The population of the world is distributed unevenly over the land area. In some places large numbers of people live close together. In other places a few people are scattered over a wide area. In which of the following nations do the people live closest together? (This nation has the most dense population.)

   China England

   Mexico Russia

2. In which of the following nations do the people live farthest apart? (This nation has the sparsest population.)

   United States France

   Brazil Nigeria

3. What is ONE reason you think people congregate in certain places of the world, and not in other places?

4. If this is true, in what kind of places in the world would you expect to find people congregated in large numbers?

5. Examine an atlas and answer the following:

   a) List the places that have large groups of people and are where you expected to find them, according to your answer to question 4.

   b) List any places where large groups of people ought to be, according to your answer to 4, but they are not there.

   c) What reasons help explain this?

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6. a) List the places where ther are <u>large groups of people that</u> are not where your answer to Question 4 says they shoud be.

b) What reasons help explain this?

7. How well does your answer to Question 3 explain the pattern of population distribution in the world?

8. IF YOUR ANSWER TO QUESTION 3 PROVIDES A COMPLETE EXPLANATION, GO DIRECTLY TO QUESTION 10.

9. IF YOUR ANSWER TO QUESTION 3 DOES NOT COMPLETELY EXPLAIN THE WAY PEOPLE ARE DISTRIBUTED THROUGHOUT THE WORLD, LIST BELOW SOME OTHER REASONS THAT MIGHT HELP EXPLAIN THIS (CHECK YOUR ANSWERS TO QUESTIONS 5c AND 6b).

10. Write a sentence that best explains why the population of the world is distributed the way it is. Be prepared to explain your reasons for this statement in the next class.

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Title: LIMITS*

Introduction:

Space on this earth is limited. It is finite. The number of people who can live on this earth is determined by many factors, such as food, land, water, and quality of air. But there is a limit somewhere to that number. This exercise helps students understand that there are finite boundaries to most situations, and these limits depend upon our assumptions. This activity will illustrate that available space in which to fit things is finite. The examples show the difficulty of predicting exact limits, even though we know that ultimate limits exist. There is a finite surface area available to hold a given population. The maximum population cannot be determined exactly, but there is a maximum.

Objectives:

To utilize math skills to calculate the maximum number of inanimate objects which can fit into a given space.

To recognize that the maximum number of animate and inanimate objects which can live in a space depends upon complex assumptions.

To distinguish between maximum possible and desirable population size.

Grade Level:

Time: one 50-minute class period

Materials: Copies of "Limits Problems" for each student

Procedure:

1. Tell the students that you would like them to work some puzzle problems which involve calculating how many objects will fit into certain spaces. Hand out the Limits Problems and let students work on them for 15-20 minutes.

2. Discuss the work the class has done.

*Adapted from an activity in An Introduction to Population, Environment, and Society by Lawrence Schaefer (New Haven, Conn: E-P Education Services, 1972).

3. What is the difference between the maximum possible amount that a space can hold, and the desired population of objects for that space? In which of the situations students worked on would they feel it is desirable to have less than maximum occupation?

4. What factors would students consider in determining the desirable number of people for the world (nation, town)? What factors would students consider in determining the maximum human population possible for the world (nation, town)? What are the similarities and differences in the two lists?

Further Suggestions:

1. In conjunction with Step 4, have students break into groups and list the factors which also work to establish limits on desirable occupation for given areas, e.g. environmental factors and terrain. Are limits established by these factors as well as by the consideration of sheer space availability?

2. Have students think of other problems that deal with putting something into a particular space. Print these, and let students work on them for credit, or as a contest activity.

LIMITS PROBLEMS

1. How many shoe boxes (1/2 ft. x 1 ft.) will fit into a steamer trunk (3 ft. x 3 ft. x 5 ft.)?

   Answer: volume of shoe box v = l x w x h = 1/6 $ft.^3$

   volume of steamer trunk v = 45 $ft.^3$

   $$\#\text{ of objects} = \frac{\text{volume of large area}}{\text{volume of single object}} = \frac{45\ ft.^3}{1/6\ ft.^3/box}$$

   = 270 boxes, an exact number

2. How many cars can fit on a parking lot (300 ft. x 150)?

   Answer: Some possible assumptions: Car size?
   Do you leave aisles?
   How many levels?

   A student can make any assumptions for car size --
   for 7' x 12' and no aisles
   area car -- 84 $ft.^2$/car
   area lot -- 45,000 $ft.^2$

   $$\#\text{ of cars} = \frac{45{,}000\ ft.^2}{84\ ft.^2/car} = 525 \text{ cars}$$
   range 300 - 1,000 cars

   There is more than one reasonable answer.

3. How many houses will fit on 100 acres of land?

   Answer: Possible assumptions: number of streets
   open spaces
   recreation areas
   number of houses per acre

   Assume - 1 house occupies 1/4 acre
   Answer: 400 houses maximum

   Assume - 1 house occupies 2 acres
   Answer: 50 houses maximum

4. How many people can live in your apartment or home?

   Answer: Assumptions: nationality
   size of home
   number of bedrooms
   how long will they stay - a weekend or year?
   zoning

   Range: 2 - 50

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Discuss: How they make their choice?
Did they need privacy?
Did they need room to feed people?
Did they need recreation area?
Did they need empty space?

5. How many students will your classroom hold? Comfortably?

Answer: Value judgement: 15 - 30 students
A teacher may relate the students' answer to population growth later. As population grows either more classrooms must be built or more students must go in each classroom. Do the students feel a small class size maximizes learning? What effect does a large class have on learning?

6. What is the maximum number of people that can live in your city or town?

Answer: Open ended. Emphasize the difficulty of predicting a maximum population for such a large area. The class should realize that, even though the limit cannot be exactly predicted, a finite limit exists on the number of people that can be accommodated. Discuss the importance of resources such as food and water. Have the class distinguish between absolute limits and desirable numbers.

Optional:

7. How many fish can live in a 20 gallon aquarium?

Answer: Assumption: size of aquarium
size of fish
type of fish
oxygen source - plants or mechanical?

No correct answer. Allow discussion to include need for life support, e.g. food, oxygen, spawning area, waste removal.

Generally, goldfish need 1 gallon of water for every 2 1/2 inches of body.

8. How many people will fit in a car?

Answer: Assumption: size of car
size of people

Range: 2 - 9 people

9. How many cows can live in a 2 acre pasture?

Answer: On Western grassland, each cow needs approximately 5 acres for grazing. If a farmer provides food from an external source, more cattle can be accommodated in a smaller area, e.g. feedlots. In a feedlot, 100/300 cattle/acre.

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LIMITS PROBLEMS

1. How many shoe boxes (1/2 x 1/3 x 1 ft.) will fit into a steamer trunk (3 ft. x 3 ft. x 5 ft.)?

2. How many cars can fit on a parking lot (300 ft. x 150 ft.)?

3. How many houses will fit on 100 acres of land?

4. How many people can live in your apartment or home?

5. How many students will your classroom hold? Comfortably?

6. What is the maximum number of people that can live in your city or town?

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Title: CENSUS*

Introduction:

Taking a census is a simple method of finding out something about a group of people. Demographers usually want to find out how many people there are in a place, how fast the population is growing, what the living conditions are, how many babies die in the first year after birth, and so on. There are certain skills involved in taking an accurate census, which also provide useful information. In this activity students take their own census to find out something of interest to them about a human population.

Objectives:

To develop questions that concern a human population for which students would like responses.

To conduct a census.

To evaluate and report students' census finding to the class and to suggest other questions that could be tested, using the information gained from their census.

Grade Level: 6 - 12

Time: The time required for this activity can vary, depending on how large an area to be surveyed is, and how many questions students decide to ask. Gathering data would probably be done out of class.

Materials: Student handout, "1980 Census Questions," one copy per student. Copies of a handout showing students how to tally their census results should also be distributed to students (see example of how a tally could be recorded).

Procedure:

1. Distribute copies of student handouts. Read the questions that are asked on a census form.

2. In a class discussion, ask students to suggest other questions that might be asked to determine the characteristics of the population near their homes or school. Some questions that students might want to answer could include:

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*"Who Lives Where?" Humanself, Experimental Edition (Boulder, CO: Biological Sciences Curriculum Study, 1972).

a. How many people live in the area you wish to study?
b. What are the age and/or sex distribution patterns in the area?
c. What sorts of buildings exist in the area, and what are their uses?
d. What sorts of jobs do the people hold?
e. Are there people from different religious/ethnic backgrounds in the area, or are most of the people from the same background?

3. Ask students to select questions that they wish to answer. They may work alone or in groups. They may wish to survey the same area as a class with different students working on different questions. In a city, students could study the people in their apartment building; in the country, the people who live within a five-mile radius. In a small town or city, they might survey their blocks. The survey may be as simple or complex as you like, and it may involve any amount of time.

4. Once students have selected questions and an area to survey, help them to prepare a tally sheet for answers.

5. When students have collected their data, they should present their findings to the class. Discussions will focus on an area and its population. Questions to be asked could include:
   a. How difficult was it to collect your information? Did you have trouble getting the answers from people? If so, why?
   b. If you had difficulty, do you think the U.S. Census takers have similar problems?
   c. Did you receive any surprises as a result of your census? Did you learn new things about the area that you did not know before?
   d. If you studied age/sex/occupational patterns, did you find that the people in your area were mostly old or young, male or female, rich or poor? Did they live in apartments or houses?
   e. In small groups, make some hypotheses that you think might be true of your area, based on the census taken previously. You might wish to return to the area to test the hypotheses by taking a new census.

How to fill out your Census Form

See the filled-out example in the yellow instruction guide. This guide will help with any problems you may have.

If you need more help, call the Census Office. The telephone number of the local office is shown at the bottom of the address box on the front cover.

Use a black pencil to answer the questions. Black pencil is better to use than ballpoint or other pens.

Fill circles "O" completely, like this: ●

When you write in an answer, print or write clearly.

Make sure that answers are provided for everyone here.

See page 4 of the guide if a roomer or someone else in the household does not want to give you all the information for the form.

Answer the questions on pages 1 through 5, and then starting with pages 6 and 7, fill a pair of pages for each person in the household.

Check your answers. Then write your name, the date, and telephone number on page 20.

Mail back this form on Tuesday, April 1, or as soon afterward as you can. Use the enclosed envelope; no stamp is needed.

Please start by answering Question 1 below.

Question 1

List in Question 1

- Family members living here, including babies still in the hospital.
- Relatives living here.
- Lodgers or boarders living here.
- Other persons living here.
- College students who stay here while attending college, even if their parents live elsewhere.
- Persons who usually live here but are temporarily away (including children in boarding school below the college level).
- Persons with a home elsewhere but who stay here most of the week while working.

Do Not List in Question 1

- Any person away from here in the Armed Forces.
- Any college student who stays somewhere else while attending college.
- Any person who usually stays somewhere else most of the week while working there.
- Any person away from here in an institution such as a home for the aged or mental hospital.
- Any person staying or visiting here who has a usual home elsewhere.

1. What is the name of each person who was living here on Tuesday, April 1, 1980, or who was staying or visiting here and had no other home?

Note

If everyone here is staying only temporarily and has a usual home elsewhere, please mark this box ☐.

Then please:
- answer the questions on pages 2 through 5 only, and
- enter the address of your usual home on page 20.

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Here are the QUESTIONS ↓	These are the columns for ANSWERS → Please fill one column for each person listed in Question 1.	PERSON in column 1
2. How is this person related to the person in column 1? Fill one circle. If "Other relative" of person in column 1, give exact relationship, such as mother-in-law, niece, grandson, etc.		START in this column with the household member (or one of the members) in whose name the home is owned or rented. If there is no such person, start in this column with any adult household member.
3. Sex Fill one circle.		○ Male ○ Female
4. Is this person — Fill one circle.		○ White ○ Black or Negro ○ Japanese ○ Chinese ○ Filipino ○ Korean ○ Vietnamese ○ Indian (Amer.) ○ Asian Indian ○ Hawaiian ○ Guamanian ○ Samoan ○ Eskimo ○ Aleut ○ Other — Specify Print write →
5. Age, and month and year of birth a. Print age at last birthday. b. Print month and fill one circle. c. Print year in the spaces, and fill one circle below each number.		a. Age at last birthday b. Month of birth ○ Jan.—Mar. ○ Apr.—June ○ July—Sept. ○ Oct.—Dec. c. Year of birth 1 ● 8 ○ 9 ○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○
6. Marital status Fill one circle.		○ Now married ○ Widowed ○ Divorced ○ Separated ○ Never married
7. Is this person of Spanish/Hispanic origin or descent? Fill one circle.		○ No (not Spanish/Hispanic) ○ Yes, Mexican, Mexican-Amer., Chicano ○ Yes, Puerto Rican ○ Yes, Cuban ○ Yes, other Spanish/Hispanic
8. Since February 1, 1980, has this person attended regular school or college at any time? Fill one circle. Count nursery school, kindergarten, elementary school, and schooling which leads to a high school diploma or college degree.		○ No, has not attended since February 1 ○ Yes, public school, public college ○ Yes, private, church-related ○ Yes, private, not church-related
9. What is the highest grade (or year) of regular school this person has ever attended? Fill one circle. If now attending school, mark grade person is in. If high school was finished by equivalency test (GED), mark "12."		Highest grade attended: ○ Nursery school ○ Kindergarten Elementary through high school (grade or year) 1 2 3 4 5 6 7 8 9 10 11 12 College (academic year) 1 2 3 4 5 6 7 8 or more ○ Never attended school — Skip question 10
10. Did this person finish the highest grade (or year) attended? Fill one circle.		○ Now attending this grade (or year) ○ Finished this grade (or year) ○ Did not finish this grade (or year)
		CENSUS USE ONLY A. ○ I ○ N ○ ○

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NOW PLEASE ANSWER QUESTIONS H1—H12 FOR YOUR HOUSEHOLD

If you listed more than 7 persons in Question 1, please see note on page 20.

H1. Did you leave anyone out of Question 1 because you were not sure if the person should be listed — *for example, a new baby still in the hospital, a lodger who also has another home, or a person who stays here once in a while and has no other home?*

- ○ Yes — *On page 20 give name(s) and reason left out.*
- ○ No

H2. Did you list anyone in Question 1 who is away from home now — *for example, on a vacation or in a hospital?*

- ○ Yes — *On page 20 give name(s) and reason person is away.*
- ○ No

H3. Is anyone visiting here who is not already listed?

- ○ Yes — *On page 20 give name of each visitor for whom there is no one at the home address to report the person to a census taker.*
- ○ No

H4. How many living quarters, occupied and vacant, are at this address?

- ○ One
- ○ 2 apartments or living quarters
- ○ 3 apartments or living quarters
- ○ 4 apartments or living quarters
- ○ 5 apartments or living quarters
- ○ 6 apartments or living quarters
- ○ 7 apartments or living quarters
- ○ 8 apartments or living quarters
- ○ 9 apartments or living quarters
- ○ 10 or more apartments or living quarters
- ○ This is a mobile home or trailer

H5. Do you enter your living quarters —

- ○ Directly from the outside or through a common or public hall?
- ○ Through someone else's living quarters?

H6. Do you have complete plumbing facilities in your living quarters, that is, hot and cold piped water, a flush toilet, and a bathtub or shower?

- ○ Yes, for this household only
- ○ Yes, but also used by another household
- ○ No, have some but not all plumbing facilities
- ○ No plumbing facilities in living quarters

H7. How many rooms do you have in your living quarters?
Do not count bathrooms, porches, balconies, foyers, halls, or half-rooms.

- ○ 1 room
- ○ 2 rooms
- ○ 3 rooms
- ○ 4 rooms
- ○ 5 rooms
- ○ 6 rooms
- ○ 7 rooms
- ○ 8 rooms
- ○ 9 or more rooms

H8. Are your living quarters —

- ○ Owned or being bought by you or by someone else in this household?
- ○ Rented for cash rent?
- ○ Occupied without payment of cash rent?

H9. Is this apartment (house) part of a condominium?

- ○ No
- ○ Yes, a condominium

H10. *If this is a one-family house* —

a. Is the house on a property of 10 or more acres?

- ○ Yes
- ○ No

b. Is any part of the property used as a commercial establishment or medical office?

- ○ Yes
- ○ No

H11. *If you live in a one-family house or a condominium unit which you own or are buying* —

What is the value of this property, that is, how much do you think this property (house and lot or condominium unit) would sell for if it were for sale?

Do not answer this question if this is —

- A mobile home or trailer
- A house on 10 or more acres
- A house with a commercial establishment or medical office on the property

- ○ Less than $10,000
- ○ $10,000 to $14,999
- ○ $15,000 to $17,499
- ○ $17,500 to $19,999
- ○ $20,000 to $22,499
- ○ $22,500 to $24,999
- ○ $25,000 to $27,499
- ○ $27,500 to $29,999
- ○ $30,000 to $34,999
- ○ $35,000 to $39,999
- ○ $40,000 to $44,999
- ○ $45,000 to $49,999
- ○ $50,000 to $54,999
- ○ $55,000 to $59,999
- ○ $60,000 to $64,999
- ○ $65,000 to $69,999
- ○ $70,000 to $74,999
- ○ $75,000 to $79,999
- ○ $80,000 to $89,999
- ○ $90,000 to $99,999
- ○ $100,000 to $124,999
- ○ $125,000 to $149,999
- ○ $150,000 to $199,999
- ○ $200,000 or more

H12. *If you pay rent for your living quarters* —

What is the monthly rent?

If rent is not paid by the month, see the instruction guide on how to figure a monthly rent.

- ○ Less than $50
- ○ $50 to $59
- ○ $60 to $69
- ○ $70 to $79
- ○ $80 to $89
- ○ $90 to $99
- ○ $100 to $109
- ○ $110 to $119
- ○ $120 to $129
- ○ $130 to $139
- ○ $140 to $149
- ○ $150 to $159
- ○ $160 to $169
- ○ $170 to $179
- ○ $180 to $189
- ○ $190 to $199
- ○ $200 to $224
- ○ $225 to $249
- ○ $250 to $274
- ○ $275 to $299
- ○ $300 to $349
- ○ $350 to $399
- ○ $400 to $499
- ○ $500 or more

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ALSO ANSWER TH

H13. Which best describes this building?
Include all apartments, flats, etc., even if vacant.

- ○ A mobile home or trailer
- ○ A one-family house detached from any other house
- ○ A one-family house attached to one or more houses
- ○ A building for 2 families
- ○ A building for 3 or 4 families
- ○ A building for 5 to 9 families
- ○ A building for 10 to 19 families
- ○ A building for 20 to 49 families
- ○ A building for 50 or more families
- ○ A boat, tent, van, etc.

H14a. How many stories (floors) are in this building?
Count an attic or basement as a story if it has any finished rooms for living purposes.

- ○ 1 to 3 — *Skip to H15*
- ○ 4 to 6
- ○ 7 to 12
- ○ 13 or more stories

b. Is there a passenger elevator in this building?

- ○ Yes
- ○ No

H15a. Is this building —

- ○ On a city or suburban lot, or on a place of less than 1 acre? — *Skip to H16*
- ○ On a place of 1 to 9 acres?
- ○ On a place of 10 or more acres?

b. Last year, 1979, did sales of crops, livestock, and other farm products from this place amount to —

- ○ Less than $50 (or None)
- ○ $50 to $249
- ○ $250 to $599
- ○ $600 to $999
- ○ $1,000 to $2,499
- ○ $2,500 or more

H16. Do you get water from —

- ○ A public system *(city water department, etc.)* or private company?
- ○ An individual drilled well?
- ○ An individual dug well?
- ○ Some other source *(a spring, creek, river, cistern, etc.)*?

H17. Is this building connected to a public sewer?

- ○ Yes, connected to public sewer
- ○ No, connected to septic tank or cesspool
- ○ No, use other means

H18. About when was this building originally built? *Mark when the building was first constructed, not when it was remodeled, added to, or converted.*

- ○ 1979 or 1980
- ○ 1975 to 1978
- ○ 1970 to 1974
- ○ 1960 to 1969
- ○ 1950 to 1959
- ○ 1940 to 1949
- ○ 1939 or earlier

H19. When did the person listed in column 1 move into this house (or apartment)?

- ○ 1979 or 1980
- ○ 1975 to 1978
- ○ 1970 to 1974
- ○ 1960 to 1969
- ○ 1950 to 1959
- ○ 1949 or earlier
- ○ Always lived here

H20. How are your living quarters heated?
Fill one circle for the kind of heat used most.

- ○ Steam or hot water system
- ○ Central warm-air furnace with ducts to the individual rooms *(Do not count electric heat pumps here)*
- ○ Electric heat pump
- ○ Other built-in electric units *(permanently installed in wall, ceiling, or baseboard)*
- ○ Floor, wall, or pipeless furnace
- ○ Room heaters with flue or vent, burning gas, oil, or kerosene
- ○ Room heaters without flue or vent, burning gas, oil, or kerosene *(not portable)*
- ○ Fireplaces, stoves, or portable room heaters of any kind
- ○ No heating equipment

H21a. Which fuel is used most for house heating?

- ○ Gas: from underground pipes serving the neighborhood
- ○ Gas: bottled, tank, or LP
- ○ Electricity
- ○ Fuel oil, kerosene, etc.
- ○ Coal or coke
- ○ Wood
- ○ Other fuel
- ○ No fuel used

b. Which fuel is used most for water heating?

- ○ Gas: from underground pipes serving the neighborhood
- ○ Gas: bottled, tank, or LP
- ○ Electricity
- ○ Fuel oil, kerosene, etc.
- ○ Coal or coke
- ○ Wood
- ○ Other fuel
- ○ No fuel used

c. Which fuel is used most for cooking?

- ○ Gas: from underground pipes serving the neighborhood
- ○ Gas: bottled, tank, or LP
- ○ Electricity
- ○ Fuel oil, kerosene, etc.
- ○ Coal or coke
- ○ Wood
- ○ Other fuel
- ○ No fuel used

H22. What are the costs of utilities and fuels for your living quarters?

a. Electricity
$ _____ .00 OR
Average monthly cost
- ○ Included in rent or no charge
- ○ Electricity not used

b. Gas
$ _____ .00 OR
Average monthly cost
- ○ Included in rent or no charge
- ○ Gas not used

c. Water
$ _____ .00 OR
Yearly cost
- ○ Included in rent or no charge

d. Oil, coal, kerosene, wood, etc.
$ _____ .00 OR
Yearly cost
- ○ Included in rent or no charge
- ○ These fuels not used

H23. Do you have complete kitchen facilities? *Complete kitchen facilities are a sink with piped water, a range or cookstove, and a refrigerator.*

- ○ Yes
- ○ No

H24. How many bedrooms do you have?
Count rooms used mainly for sleeping even if used also for other purposes.

- ○ No bedroom
- ○ 1 bedroom
- ○ 2 bedrooms
- ○ 3 bedrooms
- ○ 4 bedrooms
- ○ 5 or more bedrooms

H25. How many bathrooms do you have?
A complete bathroom is a room with flush toilet, bathtub or shower, and wash basin with piped water.

A half bathroom has at least a flush toilet or bathtub or shower, but does not have all the facilities for a complete bathroom.

- ○ No bathroom, or only a half bathroom
- ○ 1 complete bathroom
- ○ 1 complete bathroom, plus half bath(s)
- ○ 2 or more complete bathrooms

H26. Do you have a telephone in your living quarters?

- ○ Yes
- ○ No

H27. Do you have air conditioning?

- ○ Yes, a central air-conditioning system
- ○ Yes, 1 individual room unit
- ○ Yes, 2 or more individual room units
- ○ No

H28. How many automobiles are kept at home for use by members of your household?

- ○ None
- ○ 1 automobile
- ○ 2 automobiles
- ○ 3 or more automobiles

H29. How many vans or trucks of one-ton capacity or less are kept at home for use by members of your household?

- ○ None
- ○ 1 van or truck
- ○ 2 vans or trucks
- ○ 3 or more vans or trucks

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FOR YOUR HOUSEHOLD

Please answer H30–H32 if you live in a one-family house which you own or are buying, unless this is –

- A mobile home or trailer . . . . . }
- A house on 10 or more acres . . . . . } *If any of these, or if you rent your unit or this is a multi-family structure, skip H30 to H33 and turn to page 6.*
- A condominium unit . . . . . }
- A house with a commercial establishment or medical office on the property . . . . . }

H30. What were the real estate taxes on this property last year?

$ _____ .00 OR ○ None

H31. What is the annual premium for fire and hazard insurance on this property?

$ _____ .00 OR ○ None

H32a. Do you have a mortgage, deed of trust, contract to purchase, or similar debt on this property?

- ○ Yes, mortgage, deed of trust, or similar debt
- ○ Yes, contract to purchase
- ○ No — *Skip to page 6*

b. Do you have a second or junior mortgage on this property?

○ Yes ○ No

c. How much is your total regular monthly payment to the lender?
Also include payments on a contract to purchase and to lenders holding second or junior mortgages on this property.

$ _____ .00 OR ○ No regular payment required — *Skip to page 6*

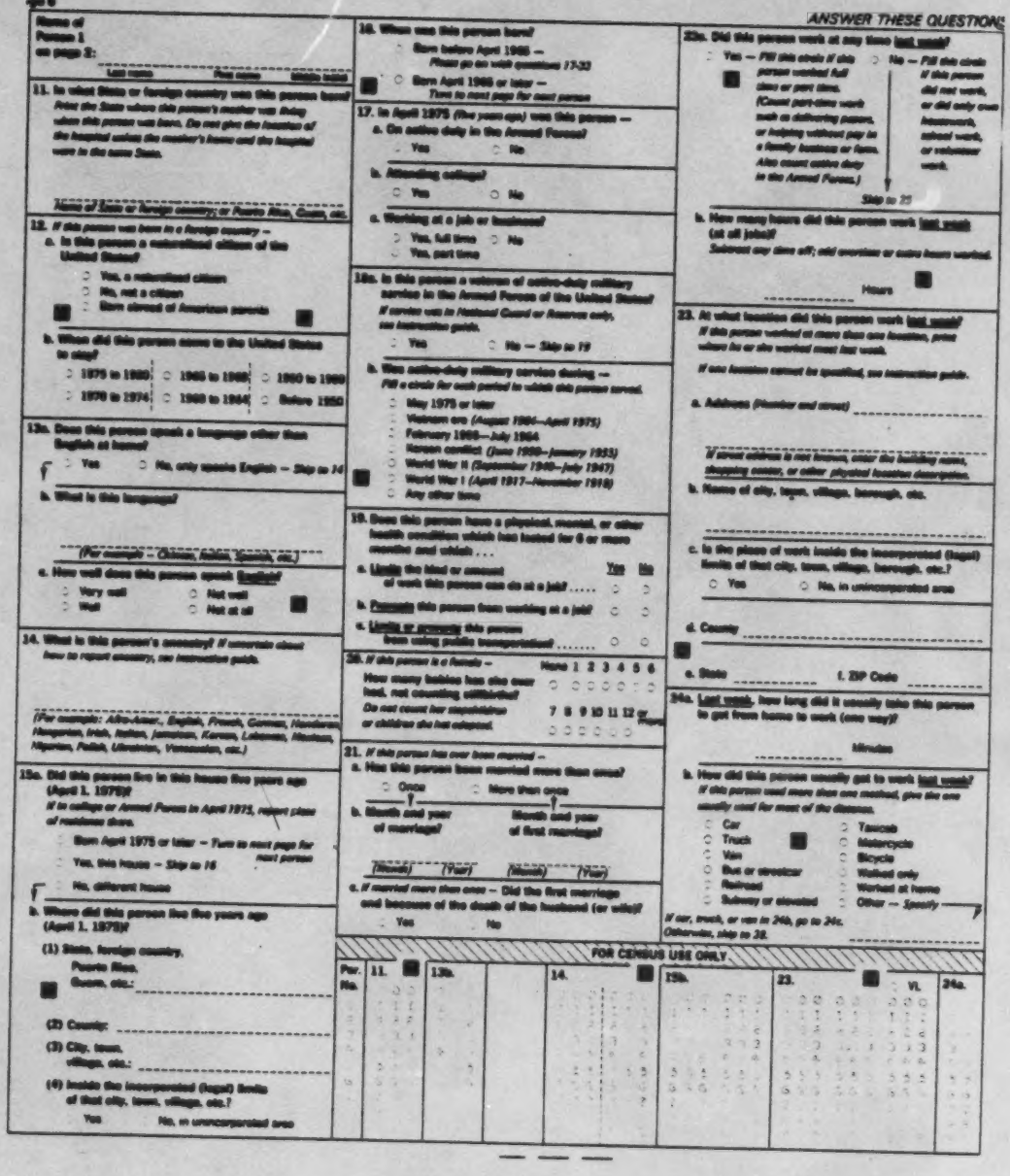
d. Does your regular monthly payment (amount entered in H32c) include payments for real estate taxes on this property?

- ○ Yes, taxes included in payment
- ○ No, taxes paid separately or taxes not required

e. Does your regular monthly payment (amount entered in H32c) include payments for fire and hazard insurance on this property?

- ○ Yes, insurance included in payment
- ○ No, insurance paid separately or no insurance

Please turn to page 6



ANSWER THESE QUESTIONS

Name of Person 1 on page 2:

Last name | First name | Middle initial

11. In what State or foreign country was this person born?
Print the State where this person's mother was living when this person was born. Do not give the location of the hospital unless the mother's home and the hospital were in the same State.

Name of State or foreign country, or Puerto Rico, Guam, etc.

12. If this person was born in a foreign country —
a. Is this person a naturalized citizen of the United States?
○ Yes, a naturalized citizen
○ No, not a citizen
○ Born abroad of American parents

b. When did this person come to the United States to stay?
○ 1975 to 1980 ○ 1965 to 1969 ○ 1950 to 1959
○ 1970 to 1974 ○ 1960 to 1964 ○ Before 1950

13a. Does this person speak a language other than English at home?
○ Yes ○ No, only speaks English — Skip to 14

b. What is this language?
(For example — Chinese, Italian, Spanish, etc.)

c. How well does this person speak English?
○ Very well ○ Not well
○ Well ○ Not at all

14. What is this person's ancestry? If uncertain about how to report ancestry, see instruction guide.
(For example: Afro-Amer., English, French, German, Honduran, Hungarian, Irish, Italian, Jamaican, Korean, Lebanese, Mexican, Nigerian, Polish, Ukrainian, Venezuelan, etc.)

15a. Did this person live in this house five years ago (April 1, 1975)?
If in college or Armed Forces in April 1975, report place of residence there.
○ Born April 1975 or later — Turn to next page for next person
○ Yes, this house — Skip to 16
○ No, different house

b. Where did this person live five years ago (April 1, 1975)?
(1) State, foreign country, Puerto Rico, Guam, etc.:
(2) County:
(3) City, town, village, etc.:
(4) Inside the incorporated (legal) limits of that city, town, village, etc.?
○ Yes ○ No, in unincorporated area

16. When was this person born?
○ Born before April 1960 — Please go on with questions 17-23
○ Born April 1960 or later — Turn to next page for next person

17. In April 1975 (five years ago) was this person —
a. On active duty in the Armed Forces?
○ Yes ○ No

b. Attending college?
○ Yes ○ No

c. Working at a job or business?
○ Yes, full time ○ No
○ Yes, part time

18a. Is this person a veteran of active-duty military service in the Armed Forces of the United States?
If service was in National Guard or Reserves only, see instruction guide.
○ Yes ○ No — Skip to 19

b. Was active-duty military service during —
Fill a circle for each period in which this person served.
○ May 1975 or later
○ Vietnam era (August 1964–April 1975)
○ February 1955–July 1964
○ Korean conflict (June 1950–January 1955)
○ World War II (September 1940–July 1947)
○ World War I (April 1917–November 1918)
○ Any other time

19. Does this person have a physical, mental, or other health condition which has lasted for 6 or more months and which . . .

	Yes	No
a. Limits the kind or amount of work this person can do at a job?	○	○
b. Prevents this person from working at a job?	○	○
c. Limits or prevents this person from using public transportation?	○	○

20. If this person is a female —
How many babies has she ever had, not counting stillbirths?
Do not count her stepchildren or children she has adopted.
None 1 2 3 4 5 6
7 8 9 10 11 12 or more

21. If this person has ever been married —
a. Has this person been married more than once?
○ Once ○ More than once

b. Month and year of marriage? (Month) (Year)
Month and year of first marriage? (Month) (Year)

c. If married more than once — Did the first marriage end because of the death of the husband (or wife)?
○ Yes ○ No

22a. Did this person work at any time last week?
○ Yes — Fill this circle if this person worked full time or part time. (Count part-time work such as delivering papers, or helping without pay in a family business or farm. Also count active duty in the Armed Forces.)
○ No — Fill this circle if this person did not work, or did only own housework, school work, or volunteer work.
Skip to 23

b. How many hours did this person work last week (at all jobs)?
Subtract any time off; add overtime or extra hours worked.
Hours

23. At what location did this person work last week?
If this person worked at more than one location, print where he or she worked most last week.
If one location cannot be specified, see instruction guide.

a. Address (Number and street)
If street address is not known, enter the building name, shopping center, or other physical location description.

b. Name of city, town, village, borough, etc.

c. Is the place of work inside the incorporated (legal) limits of that city, town, village, borough, etc.?
○ Yes ○ No, in unincorporated area

d. County

e. State f. ZIP Code

24a. Last week, how long did it usually take this person to get from home to work (one way)?
Minutes

b. How did this person usually get to work last week?
If this person used more than one method, give the one usually used for most of the distance.
○ Car ○ Taxicab
○ Truck ○ Motorcycle
○ Van ○ Bicycle
○ Bus or streetcar ○ Walked only
○ Railroad ○ Worked at home
○ Subway or elevated ○ Other — Specify
If car, truck, or van in 24b, go to 24c. Otherwise, skip to 25.

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Per. No.	11.	13b.	14.	15b.	23.	VI.	24a.

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PERSON 1 ON PAGE 2

c. When going to work last week, did this person usually —
- ○ Drive alone — *Skip to 28*
- ○ Share driving
- ○ Drive others only
- ○ Ride as passenger only

d. How many people, including this person, usually rode to work in the car, truck, or van last week?
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7 or more

After answering 24d, skip to 28.

25. Was this person temporarily absent or on layoff from a job or business last week?
- ○ Yes, on layoff
- ○ Yes, on vacation, temporary illness, labor dispute, etc.
- ○ No

26a. Has this person been looking for work during the last 4 weeks?
- ○ Yes
- ○ No — *Skip to 27*

b. Could this person have taken a job last week?
- ○ No, already has a job
- ○ No, temporarily ill
- ○ No, other reasons *(In school, etc.)*
- ○ Yes, could have taken a job

27. When did this person last work, even for a few days?
- ○ 1980
- ○ 1979
- ○ 1978
- ○ 1975 to 1977
- ○ 1970 to 1974
- ○ 1969 or earlier
- ○ Never worked

Skip to 31d

28–30. Current or most recent job activity

Describe clearly this person's chief job activity or business last week. If this person had more than one job, describe the one at which this person worked the most hours. If this person had no job or business last week, give information for last job or business since 1975.

28. Industry

a. For whom did this person work? *If now on active duty in the Armed Forces, print "AF" and skip to question 31.*

(Name of company, business, organization, or other employer)

b. What kind of business or industry was this?
Describe the activity at location where employed.

(For example: Hospital, newspaper publishing, mail order house, auto engine manufacturing, breakfast cereal manufacturing)

c. Is this mainly — *(Fill one circle)*
- ○ Manufacturing
- ○ Wholesale trade
- ○ Retail trade
- ○ Other — *(agriculture, construction, service, government, etc.)*

29. Occupation

a. What kind of work was this person doing?

(For example: Registered nurse, personnel manager, supervisor of order department, gasoline engine assembler, grinder operator)

b. What were this person's most important activities or duties?

(For example: Patient care, directing hiring policies, supervising order clerks, assembling engines, operating grinding mill)

30. Was this person — *(Fill one circle)*
- Employee of private company, business, or individual, for wages, salary, or commissions ○
- Federal government employee ○
- State government employee ○
- Local government employee *(city, county, etc.)* ○
- Self-employed in own business, professional practice, or farm —
  - Own business not incorporated ○
  - Own business incorporated ○
- Working without pay in family business or farm ○

CENSUS USE

21b. I II III IV

22b.

28. A B C D E F G H J K L M AF NW

29. N P Q R S T U V W X Y Z

31a. Last year (1979), did this person work, even for a few days, at a paid job or in a business or farm?
- ○ Yes
- ○ No — *Skip to 31d*

b. How many weeks did this person work in 1979?
Count paid vacation, paid sick leave, and military service.

_____ Weeks

c. During the weeks worked in 1979, how many hours did this person usually work each week?

_____ Hours

d. Of the weeks not worked in 1979 (if any), how many weeks was this person looking for work or on layoff from a job?

_____ Weeks

32. Income in 1979 —

Fill circles and print dollar amounts.
If net income was a loss, write "Loss" above the dollar amount.
If exact amount is not known, give best estimate. For income received jointly by household members, see instruction guide.

During 1979 did this person receive any income from the following sources?

If "Yes" to any of the sources below — How much did this person receive for the entire year?

a. Wages, salary, commissions, bonuses, or tips from all jobs . . . *Report amount before deductions for taxes, bonds, dues, or other items.*
- ○ Yes → $ _____ .00
- ○ No

(Annual amount – Dollars)

b. Own nonfarm business, partnership, or professional practice . . . *Report net income after business expenses.*
- ○ Yes → $ _____ .00
- ○ No

(Annual amount – Dollars)

c. Own farm. . .
Report net income after operating expenses. Include earnings as a tenant farmer or sharecropper.
- ○ Yes → $ _____ .00
- ○ No

(Annual amount – Dollars)

d. Interest, dividends, royalties, or net rental income . . .
Report even small amounts credited to an account.
- ○ Yes → $ _____ .00
- ○ No

(Annual amount – Dollars)

e. Social Security or Railroad Retirement . . .
- ○ Yes → $ _____ .00
- ○ No

(Annual amount – Dollars)

f. Supplemental Security (SSI), Aid to Families with Dependent Children (AFDC), or other public assistance or public welfare payments . . .
- ○ Yes → $ _____ .00
- ○ No

(Annual amount – Dollars)

g. Unemployment compensation, veterans' payments, pensions, alimony or child support, or any other sources of income received regularly . . .
Exclude lump-sum payments such as money from an inheritance or the sale of a home.
- ○ Yes → $ _____ .00
- ○ No

(Annual amount – Dollars)

33. What was this person's total income in 1979?

Add entries in questions 32a through g; subtract any losses.

$ _____ .00

(Annual amount – Dollars)

If total amount was a loss, write "Loss" above amount.

OR ○ None

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POPULATION DISTRIBUTION DATA FORM

(1) BUILDING NUMBER	(2) BUILDING AGE	(3) NUMBER OF RESIDENTS	(4) AGES OF PEOPLE	(5) SEXES OF PEOPLE	(6) BUILDING USE	(7) OCCUPATIONS OF RESIDENTS	(8) ETHNIC PATTERN	(9) BELIEF PATTERNS
449 Apricot	60 Years	18	[illegible]	[illegible]	Apartment	Students Blue Collar White Collar	Black, Indian White, Other	Catholic, Protestant, Other
451 "	54 Years	3	67 70 73	M F F	Single Family	Retired	White	Catholic
453 "	20 Years	—	—	—	Business	—	—	—
455 "	(?)	(± 20)	—	—	Apartment	Students White Collar	Black, White	(?)

Population distribution data form.

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Title: DOES STRENGTH LIE IN NUMBERS?*

Introduction:

Implicit in many of our daily actions is the value placed on numbers. For instance: "The bigger the better," "100%," "We have more washing machines than anybody else in the world." In fact, in many cases, quantity is our goal and not quality, although we might not like to admit it. This is not to suggest that people don't value quality, but it is to say that we often value quantity more.

Objectives:

To document the value of numbers (quantity) in the students' society by practices and customs that reveal attitudes toward numbers.

To consider the value of numbers by examining population data for selected countries around the world.

To explore data related to numbers to determine when numbers relate to quantity and when numbers relate to quality.

Grade Level: 7 - 12

Time: Two class periods

Materials: Duplicate copies of "Does Strength Lie in Numbers" for use during the second part of the activity.

Procedure:

1. Begin the activity by asking students to divide a sheet of paper into two columns. One column should be titled "More is Better" and the other "More is Worse." Ask the students to work alone or in pairs and identify situations where having more people or a bigger quantity is advantageous and where more is disadvantageous. Encourage the students by seeing who can get the largest list in the shortest time.

   Examples from the "More is Better" column might includes money, soldiers on your side in war, and miles per gallon you get on your car. Examples from the "More is Worse" column might be soldiers on the other side in war, number of pimples on the face, and number of pages to read for homework.

*Adapted from an activity by Margaret Palcynski, NSF Summer Institute, Cincinnati, Ohio, 1973.

2. Have students share their lists so that everyone gets some ideas about when numbers are valued as useful and desirable by students and when numbers are a hindrance to them.

3. The question to focus on at this point is: When is more of something valuable and when is it not? Ask students the following questions. As they answer the questions, list on the board the rationales given by students in their answers. This would provide a set of general statements about numbers and their values as students complete step 4.
   a. Is a $20 bill better than a $5 bill?
   b. Is a 200-page book better than an 85-page book?
   c. Is a 95 on a test better than a 93?
   d. Is a flower garden with 40 roses better than one with 30 roses?
   e. Is a family with eight children better than one with five?
   f. Is a nation with 200,000,000 people stronger than a nation with 30,000,000?
   g. Is a man with eight shirts better dressed than a man with five?
   h. Is a double dip ice cream cone better than a single dip?

   Make up your own questions or have students brainstorm some.

4. As the class examines the list you have compiled, raise this issue with them: "In responding to the questions, how many times did you feel that you were deciding on the basis of quantity vs. quality?" Give examples. Mention that many nations of the world today feel that strength lies in numbers. But the question is, what numbers? Hand out the worksheet titled "Does Strength Lie in Numbers?" and have the students complete them.

5. Summary. Ask the students if more of something is always good (they should say "no"). Is it always bad (they should say "no" again)? Then how does one determine when more of something is good (useful) and when it is bad (not useful)? Refer back to the list when answering these questions.

<u>Evaluation</u>:

Have the class discuss or write a reaction paper to this statement: "We as Americans are inconsistent since, most of the time, we value high numbers or quantity. It is not fair for us to be against nations with large populations or rapidly growing populations."

DOES STRENGTH LIE IN NUMBERS?

If you were a leader of a country, would you prefer to have a country

_____ with the highest total national income (Gross National Product)?
_____ with the largest population?
_____ with the highest income per person (per capita)?

What would be more advantageous in terms of your country's prospects for future progress and happiness?

Choose one of these questions or a combination of them and, then, use the following data to test your answer.

COUNTRY	POPULATION (MILLIONS)	TOTAL NATIONAL[2] GNP (U.S. $ MILLIONS)	PER CAPITA[1] INCOME (U.S. $)
Australia	14.6	115,632	7,920
China	975.0	448,500	460
India	676.2	121,716	180
Mexico	68.2	87,978	1,290
Nigeria	77.1	43,176	560
Puerto Rico	3.5	9,520	2,720
United States	222.5	2,158,250	9,700

Now. . .refer to the above figures to answer the following questions:

1. List these countries by name in descending order.

highest	Population	Total National GNP	Per Capita
1.			
2.			
3.			
4.			
5.			
6.			
7.			
smallest			

2. Connect the same country across the three columns by a line. (E.g., from U.S. in first column to U.S. in second column to U.S. in third column.)

3a. Which is the largest country? Does it have the largest total income?

3b. Which is the smallest country? Does it have the smallest total income?

---

[1]Source: 1980 World Population Data Sheet, Population Reference Bureau.
[2]Computed from these figures: population X per capita income = national GNP.

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3c. India, the second largest in population, has the second largest total income. Thus, India ranks second in terms of potential for progress and development. Comment.

3d. Why does India have a high total national income (GNP) and a low per capita income?

3e. How could India's per capita income also take second place in this list?

3f. Look at Puerto Rico. Its population is _____, and yet its GNP is _____, and its per capita is even_____.

4. Large populations and (high or low) per capita incomes do not usually go together. (Circle correct answer.)

5. If population size increases and total income does not, then per capita income will_____.

6. If population size decreases and total income remains the same, then per capita income will_____.

IN CONCLUSION:

7. Why is per capita income a better measure of a country's development and potential than its total national income?

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Title: ONE MAN'S FAMILY

Introduction:

Population growth is directly related to the number of children each person actually parents. The reading, "One Man's Family," illustrates effects of family size on population growth in dramatic fashion. After reading the article, students examine a chart that projects the growth of U.S. population based on an average of two or three children.

Objectives:

To inform students of the effects of individual family size on total population growth.

To increase student ability to analyze graphs.

Grade Level: 7 - 12

Time: One class period

Materials: Copies of "One Man's Family" and "U.S. Population, 2- vs. 3-Child Families." A transparency of the population graph would also be useful.

Procedure:

1. Ask students how many children they would like to have if they plan on raising children. Ask them if they plan to have fewer children than their parents. Their grandparents?

2. Tell students that the choice each person makes about family size can have dramatic effects on population size.

3. Distribute "One Man's Family" to the class. Ask students to read the article and identify the effects of family size on population growth.

4. Discuss these questions about the reading:
   a. How would you explain to someone the reason John Eli Miller had 410 descendants when he died?
   b. What would the effect on the number of descendants have been if Miller's children had only produced two children per family?

5. Distribute "U.S. Population, 2- vs. 3-Child Families" to students project it on an overhead projector. Ask these questions:
   a. What does each dark line curve on the graph represent?
   b. True or false. The graph talks about <u>every</u> family having two or three children with no deviation. (False: this is an <u>average</u> number per family.)
   c. What will the population of the United States be in the year 2015 if people average three children per family? If people average two children per family?
   d. How can the difference of one child per family result in 100 million less people in the United States by the year 2015?
   e. How does any of this information affect your responses to the questions at the beginning of class? How many children do you want?

<u>Evaluation</u>:

Have students write a fictitious letter to someone and explain the effects on population size of their decision to have four instead of three children.

SUMMARY. One man lived to see his descendants number 410. He expressed modern population concerns in the simple terms of "Where will they all find good farms?"

ONE MAN'S FAMILY*

by Glenn D. Everett

Recently, on the eve of his 95th birthday, John Eli Miller died in a rambling farmhouse near Middlefield, Ohio, 40 miles southeast of Cleveland, leaving to mourn his passing perhaps the largest number of living descendants any American has ever had.

He was survived by five of his seven children, 61 grandchildren, 338 great-grandchildren and six great-great-grandchildren, a grand total of 410 descendants.

Shortly before his death, which came unexpectedly from a stroke, I had the privilege of two long visits with John E. Miller, during which I learned the feeling of one man who had personally watched the population explosion of the 20th century. A national magazine had determined that the venerable Ohio farmer was head of what almost certainly was the largest family in the United States.

A Swedish newspaper in 1958 ran a competition for the largest family in that country and when a family named Hellander turned up with 265 members, headed by a 92-year-old great-grandmother, it asserted a claim to the Swedish and to the world championship.

Soon the reports of even larger families were streaming into editors, with an elderly Mormon couple in Utah claiming 334 living descendants taking the lead. However, I was certain that among the Old Order Amish Mennonites, a sect in which families of more than 100 are commonplace, a family larger than this could be found. Through the medium of the Sugarcreek, Ohio, *Budget*, a unique weekly newspaper that is read by the Old Order Amish in all their communities throughout the Nation, it was soon ascertained that John Eli Miller, with his clan of more than 400, had the largest family among them. So far as could be learned, this family was the largest in America and probably the world's largest among monogamous peoples.

When John Miller and his family refused to pose for photographs because of their religious opposition to "graven images," the magazine gave up the idea of a story about this "largest family" but the interviews disclosed a number of facts about the impact of extremely rapid population growth on this family and the cultural group of which it is a part. These facts merit the serious attention of all students of population problems.

John Miller actually had seen with his own eyes a population explosion in his own lifetime. His data were not statistics on a graph or chart, but the scores of children at every family gathering who ran up to kiss Grandpa, so many that it confused a poor old man. His confusion can be forgiven for there were among them no less than 15 John Millers, all named in his honor. And what young man, much less an old one, could remember the names of 61 grandchildren and 338 great-grandchildren and keep straight just who their parents were?

The remarkable thing about this great clan of his was that it started with a family of just seven children. This was actually a little smaller than the typical family among the Amish, who have been found by one researcher to average 8.4 children per completed family. Two of his children died in early life: Samuel Miller, who left six children when he died at 40, and Lizzie (Mrs. Jacob Farnwald), who left four when she died at 28.

During most of his long life, therefore, John Miller's family was not unusually large. It is just that he lived long enough to find out what simple multiplication can do.

One of his daughters, Mary (Mrs. Jacob Mast) had only five children. But all four of his sons had quite large families. His son, John, Jr., with whom he lived in the family homestead, had six children by his first wife, who died in an accident, and nine more by his present wife, a total of 15. Andrew Miller had 12, Eli Miller, 11, of whom ten are living, and Joseph Miller, ten, of whom nine are living.

Of the 63 grandchildren born to John Miller's family, 61 lived to survive him, all but six now grown and married. And of 341 great-grandchildren born to

*Reprinted from *Population Bulletin* 17(8):41-44, 1961, with permission of Population Reference Bureau, Inc.

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the families of his 55 married grandchildren, only three had died, two in infancy, and one in an accident. All six of his great-great-grandchildren were born during the last year of his life and were healthy infants.

Thus, a major factor in the worldwide population crisis was vividly evident in John Miller's family: the fact that nearly all children born in the 20th century, who enjoy the benefits of modern medicine, are growing up to become adults and to have families of their own. A century ago, the ravages of smallpox, typhoid fever, tuberculosis, diphtheria and the many fatalities that occurred at childbirth would have left a far different picture in a large rural family. Even though the Amish live in rural areas, they avail themselves to the benefits of medical care. Now most Amish children are born in hospital delivery rooms.

While the sharp reduction in infant mortality and childhood disease is a happy development of science, it inevitably means that population grows with extraordinary rapidity. The Miller family offers a cogent example. John Miller has seven children; his children averaged nine offspring; and his married grandchildren had averaged six each when he passed away. Six married great-grandchildren had one apiece. These were not unusually large families among the Amish nor among the rural families of other Americans in the past century. Yet this clan numbered 410 when John Miller died.

Moreover, at the end of his life, the postman was bringing John Miller word of the birth of a new descendant on the average of once every ten days. This rate, we calculated, would have accelerated to one every other day as his more than 300 great-grandchildren reached marriageable age. Only eight were married when he died and six had had children by their first wedding anniversaries.

So great is the rate of progression of population growth that had John Miller lived one more decade he would have seen more descendants born to him than in all his 95 years of life and would in ten more years have counted at least 1000 living descendants!

The rate at which population increases is almost unbelievable—even when a man is watching it happen within his own family. John Miller found it difficult to comprehend what was happening. When I told him that all available evidence indicated that he had the largest family in the United States, the kindly old man passed a gnarled hand before his failing eyes and shook his head in amazement....

What did John Miller think about his family? Did it worry him to see it growing so large? Indeed it did. Significantly, his concerns were the very ones that the demographers, the economists, the sociologists, and other serious students of world population problems have been voicing. He was not an educated man, for the Amish still believe eight grades of education in a one-room country school is sufficient, but John Miller summarized it in one simple question he constantly repeated, "Where will they all find good farms?"...

Some day, at some point, John Miller's plaintive question, "Where will they all find farms?" will have to be answered in the bleak negative. They can continue now only by buying farms others will sell them. Some day no more farms anywhere will be for sale. A finite world is of limited size. So, ultimately, at some point, is the population it can hold.

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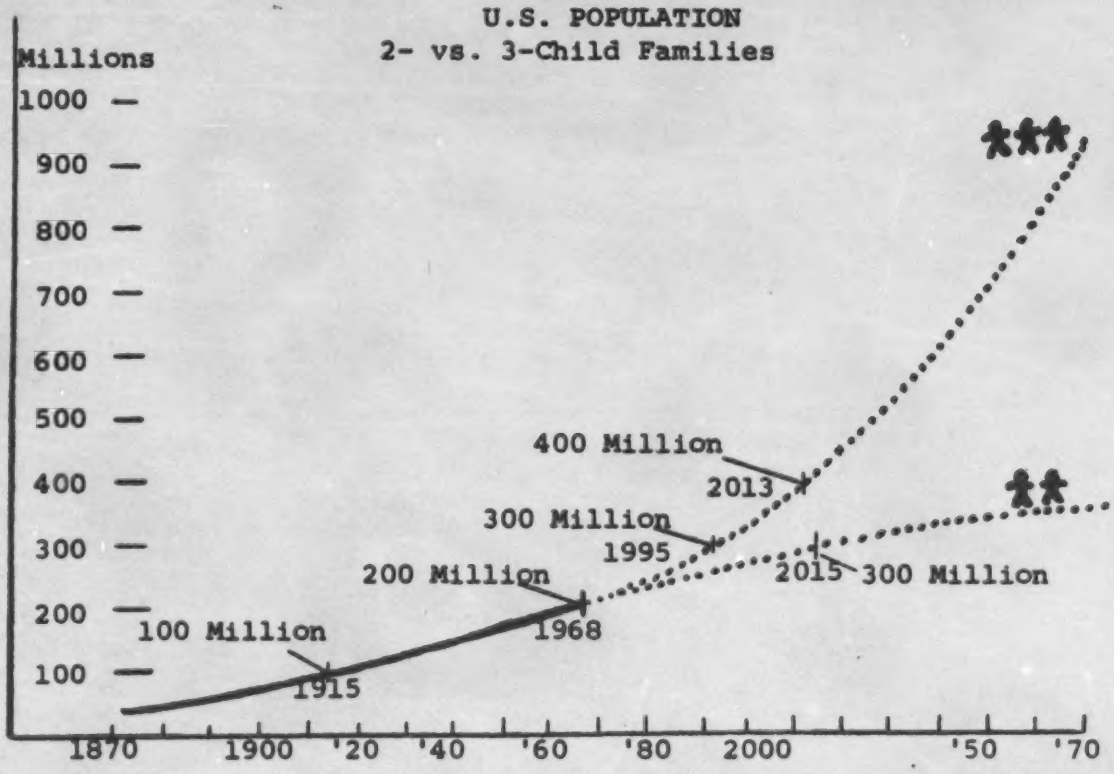

The population of the United States passed the 100 million mark in 1915 and reached 200 million in 1968. If families averaged 2 children in the future, growth rates will slow down and the population will reach 300 million in the year 2015. At the 3-child rate, the population would reach 300 million in this century and 400 million in the year 2013.

Graph from "Population and the American Future," Report of the Committee on Population Growth and the American Future (Washington, D.C.: U.S. Government Printing Office, 1972) p. 186.

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Title: IF I COULD LIVE ANY PLACE ON EARTH!

Introduction:

Many people use open space as an argument against those who suggest that the world is overpopulated. There are many factors in addition to open space that must be considered when asking how many people the earth can hold. This activity explores population distribution by first having students locate what they consider to be the ideal place to live. After examining responses, students can identify those places on the globe where people congregate due to necessity or desirability. These factors of distribution must be considered when deciding how many people the earth can hold.

Objectives:

To identify and locate the one place in the world where students would like to live and to write down three to five reasons for selecting such a place.

To share students' choices with the class.

To use group processes to compile a list of the 10 most common reasons for choosing the ideal place to live.

To consider how much of the world's land meets the criteria generated by the class and discuss the implications of such findings for the question, "How many people can live on this earth?"

Grade Level: 7 - 12

Time: Two class periods

Materials: Have a number of atlases available for student use.

Procedure:

1. Ask students if they think there is room for more people on the earth. Have students explain their responses.

2. Hand out the blank map of the world and ask students to locate the place on earth where they would want to live if they could live anywhere they choose. Have atlases available so that students can look at different countries. You may also want to give students the evening to do this activity so that they can talk with friends and parents about their choice. After students locate a place, be sure they write down three to five reasons for selecting that location.

3. If possible, locate each student's choice on a map large enough for every student to see. An overhead projector and a transparency would work quite well.

4. Have students get together in pairs to combine their lists of reasons. Then have the pairs group as fours and combine their reasons. Then have students form groups of 8 and have them arrive at the 10 most common reasons given for choosing the ideal spot to live on earth. List these on the board.

5. Have the students look at the list and the compiled map. Do people in the class tend to want to live in similar locations? In what ways are the places similar?

   Would people choose to live in deserts? Would most people choose to live in very cold regions? Would most people choose to live far from or close to water?

6. Have students consider their answers to these questions. Then ask them to think again about the question you asked at the beginning of the class, "Is there room for more people on the earth?" Do any of the factors discussed in class affect their answers and thoughts about the question now? Can we say there is room for people on the earth just because there is open space? Can people live anywhere? Do people want to live anywhere?

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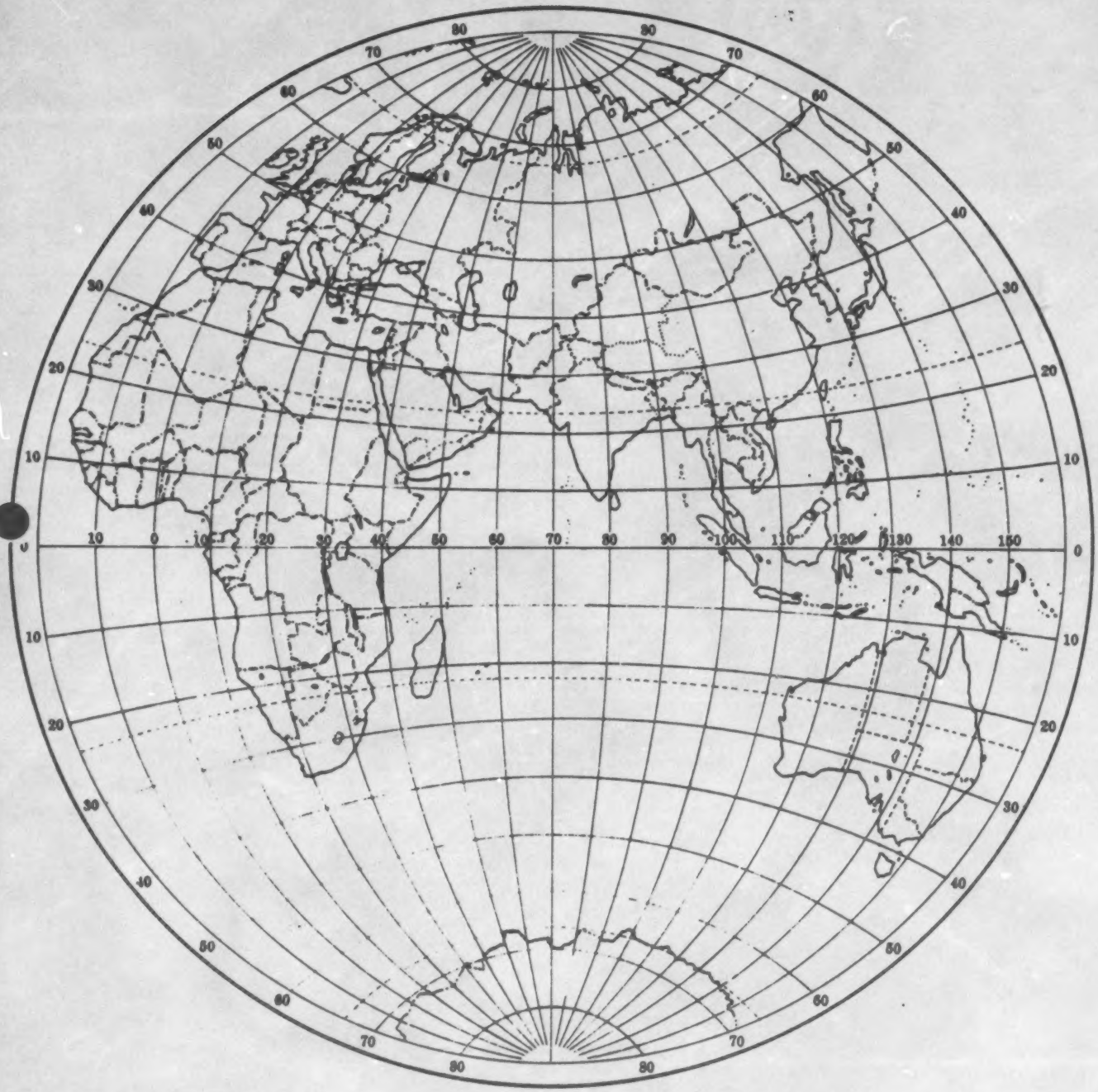
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Title: GRAPHING POPULATION GROWTH

Introduction:

Why are many people concerned about population growth today? One reason is that population grows exponentially. This activity demonstrates how a population grows regardless of the human population we consider. Students can learn about the growth of a population by reading graphs. Making a graph on population growth for the nation and then comparing this growth to world population growth will help students understand and read graphs and also understand the exponential nature of population growth.

Objectives:

To make a live graph, given raw data.

To compare the data on a graph of U.S. population with a graph of world population.

To figure the doubling time of various populations, both animate and inanimate.

Grade Level: 7 - 12

Time: One class period

Materials: Duplicate a sheet of graph paper for each student. You may give the data for the graph on either a separate handout, an overhead transparency, or the chalkboard. Duplicate graph of World Population Growth for students.

Procedure:

1. Hand out graph paper and U.S. data to students.
2. Have students graph the data.
3. Ask students why the curve rises sharply and quickly on the graph.
4. Using the slide or transparency of world population growth, explain the nature of exponential growth. Something that grows

exponentially grows at a constant percentage of the whole in a constant time period. It is useful to compare this idea to the interest collected at a bank or the doubling of a penny each day. It is also useful to think of exponential growth in terms of doubling time, or the time it takes a growing quantity to double in size. The following chart applies to any quantity:

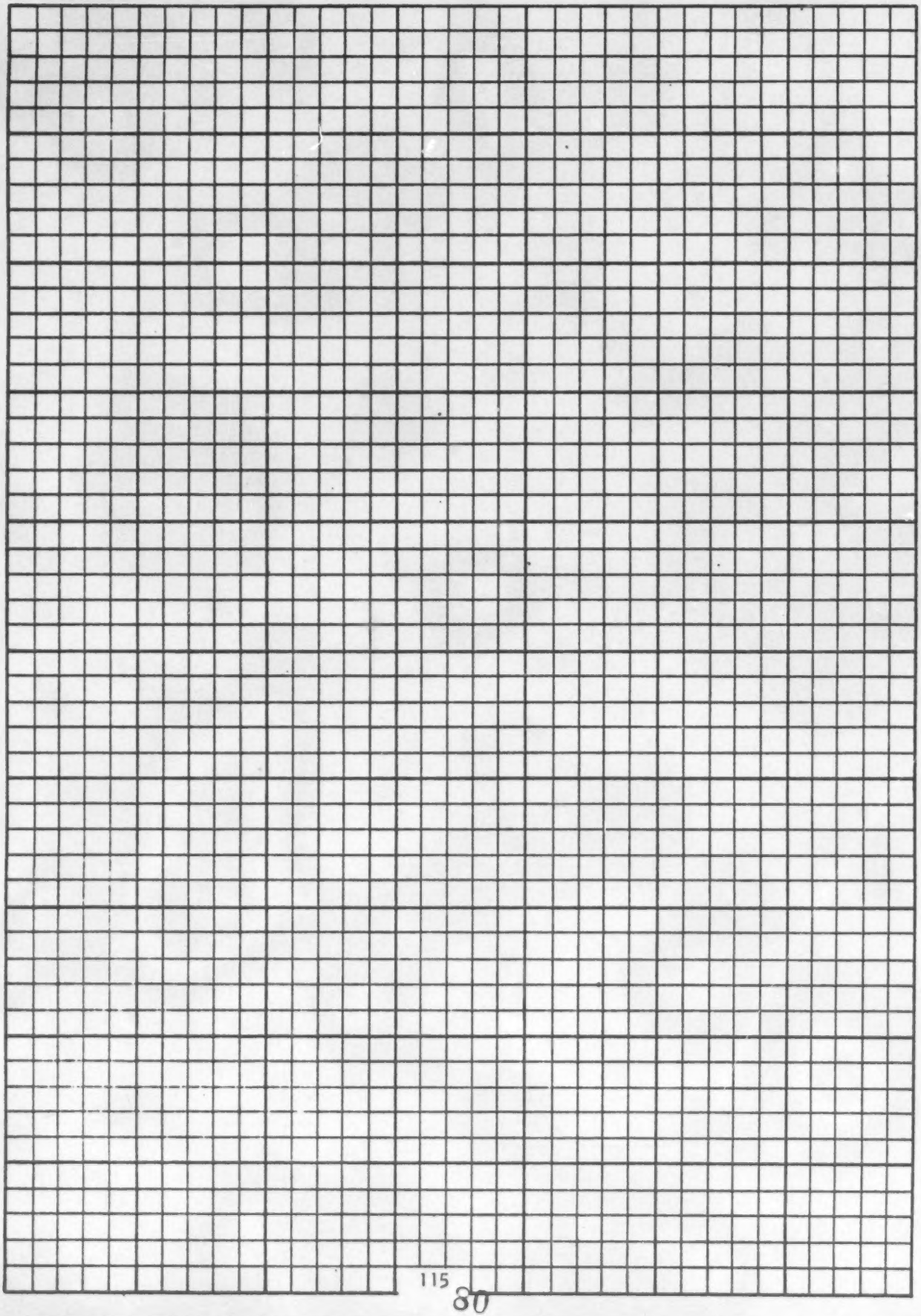
Doubling Time Chart

GROWTH RATE % per year	DOUBLING TIME years
0.1	700
0.5	140
1.0	70
2.0	35
4.0	18
5.0	14
7.0	10
10.0	7

5. Hand out World Population Growth graph to students. Compare the world population data sheet to the graph they drew for the United States. In what ways are they similar? In what ways are they different?

Further Suggestions:

Get the population growth data of a town, county, or state and graph it. Compare your graph to the graphs of other students.



DATA FOR GRAPHS

United States Population

1800	5,300,000	1890	63,000,000
1810	7,200,000	1900	76,000,000
1820	9,600,000	1910	92,000,000
1830	12,900,000	1920	105,700,000
1840	17,000,000	1930	122,800,000
1850	23,200,000	1940	131,700,000
1860	31,400,000	1950	151,300,000
1870	39,400,000	1960	179,300,000
1880	50,200,000	1970	203,200,000
		1980	222,500,000

Data rounded off to nearest hundred thousand.

Data taken from World Almanac, 1973, and 1980 World Population Data Sheet, Population Reference Bureau.

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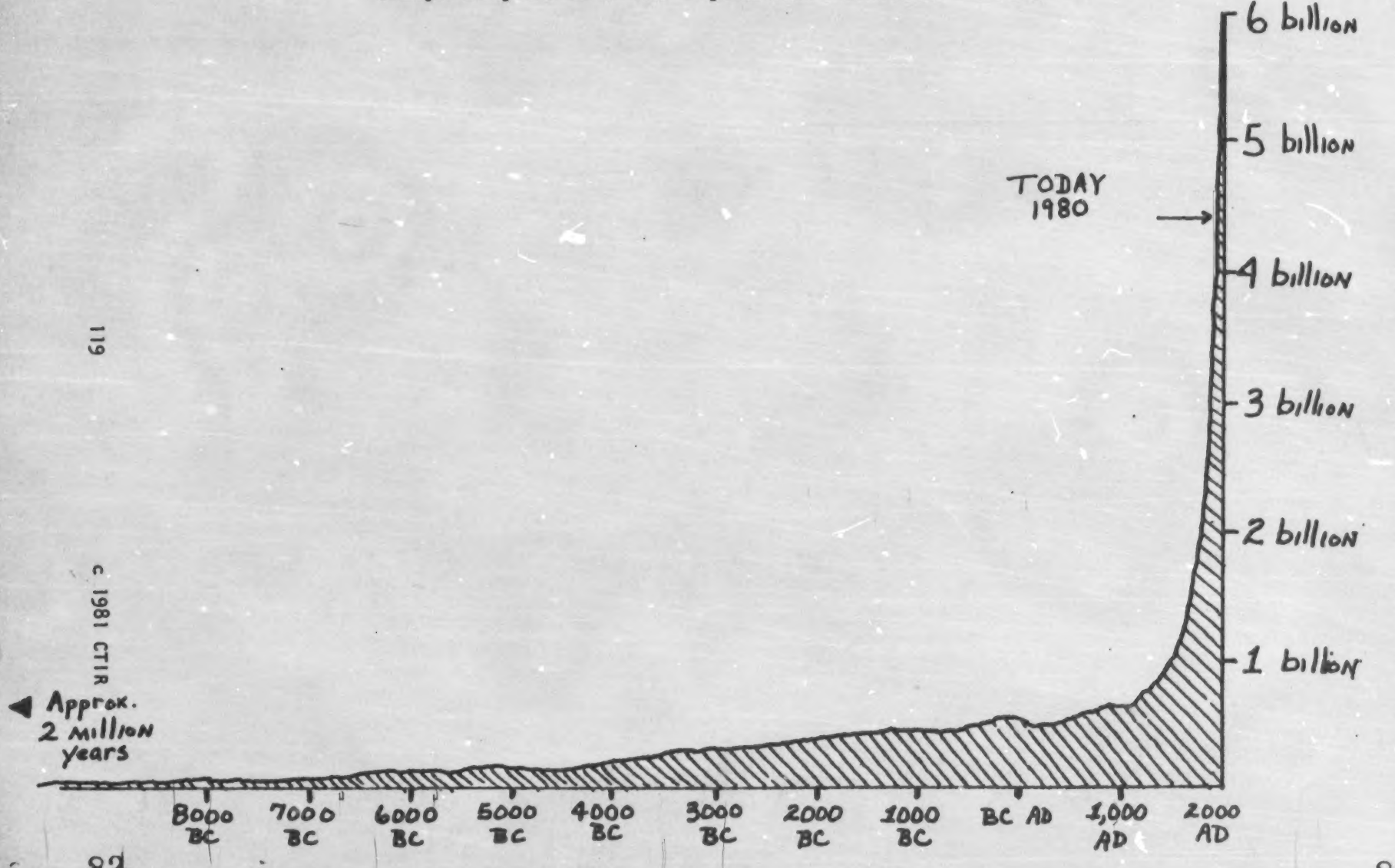
WORLD POPULATION GROWTH

(Graph adapted from The Population Reference Bureau)



119

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Title: FOOTPRINTS

Introduction:

By examining the indirect or direct evidence of the actions or existence of a population, we can learn something about that population. In this activity students explore, discover, and evaluate the direct and indirect evidence left by populations--their "footprints," so to speak.

Objectives:

To demonstrate to students that most populations leave evidence of their existence.

To allow students to make inferences about a population from the evidence it leaves.

To improve students' observational skills and abilities to understand the consequences of the actions of populations.

Grade Level: 6 - 12

Time: Two class periods

Materials: You need to duplicate handout, "Evidence." Also, you might want to supply cameras, paper, and other recording and measuring devices for use by the participants.

Procedure:

1. Tell the class that you would like them to focus on the different types of evidence that a population leaves behind--evidence that describes the population, affects other populations, and documents the existence of the population itself. A number of activities for students are given on the handout, "Evidence."

2. Hand out the "Evidence" sheet to students. Assign particular activities on the handout or let students pick an activity. Allow class time and overnight to complete the activities.

3. Have students share their evidence with the class. How are they able to determine the kind of population from the evidence they found? Can they determine the size of the population from the evidence they found? Would they consider the evidence to have negative, positive, or neutral effects on the environment?

EVIDENCE

1. Go outside and observe indirect evidence of a population of something.

2. Go inside the school, home, or other places and observe indirect evidence of a population of something.

3. Find "footprints" or evidence of the existence of a population that you think should be reduced.

4. Find "footprints" or evidence of the existence of a population that you think should be increased.

5. List 10 kinds of indirect evidence of populations.

6. Estimate the size of the population from the indirect evidence.

7. Take some evidence about a population. Using the data alone describe that population.

8. Check your evidence. What makes your direct or indirect evidence conclusive? How can you be sure that the evidence you have is direct or indirect evidence of a population?

Title: MODELING POPULATION GROWTH*

Introduction: This exercise is designed to help the student understand exponential growth and doubling time when applied to human population. It explores human population growth in three situations: unrestricted exponential growth, institution of a limited birth control program, and a zero population growth plan. Additional information is given in the exercise to help the student develop attitudes regarding the effects of population growth on the human condition.

Objectives:

To demonstrate an understanding of exponential growth and doubling time.

To list several effects that exponential growth of the human population may have on the human condition.

To operate more effectively in a group situation.

Grade Level: 5-12

Time: Two to three class periods.

Materials: Student handout which includes instructions, charts for completion, additional information concerned with population growth, and questions for response. You will need 200 dice per group. One side of the dice should be blue, one side should be red, and one side should be black. The other three sides can be white or blank. Cubes can be obtained from math and science catalogs or cut for you in the shop.

Procedure:

1. Divide the class into groups of four to six. Do not explain the reason for the exercise to the students. Allow the students to reach their own conclusions. Hand out the student exercise sheets and the cans of dice. Go over the directions with the students and then let each group operate as much as possible on their own.

2. After the students have collected the data on their charts, they may transfer this information onto graphs if you wish.

3. In a class discussion, allow the groups to compare their results.

*Adapted from an activity developed by John Christiansen and John Crouch.

4. During the class discussion, raise questions of the following nature:
   a. What did you learn from this exercise?
   b. Which population plan had the greatest appeal to you?
   c. Which population plan has operated during most of man's history?
   d. How often did your population double and how often do you predict it to double under each population plan?
   e. Comment on the following: "If we solve the population problem, we will have a chance at solving all other problems. If we don't solve the population problem, none of the others will matter." Do you agree with this statement? Why or why not?

MODELING POPULATION GROWTH

NAME _____

Introduction:

In this experiment you will use dice to model population growth. Each die represents a person. Each throw of the dice represents a year. A blue or a red represents the birth of a child, so each time one of them comes up, add a die to the population. If a black comes up, a death has occurred, so remove it from the population. Hence you are modeling a situation where the birth rate is twice the death rate. You also have a population growth rate of 1/6 or about 17%.

Procedure:

PART A: Unrestricted Exponential Growth

Put 6 ordinary dice into a container (Adam, Eve, Cain, Abel, Sally, and Alice). Shake the container and dump the contents out onto a smooth, hard floor. Remove and count all the black sides that appear. A "black" is analogous to a death. Record the number of deaths on the chart. Count up all the reds and blues that appear. Since they correspond to birth, add a die for each of them. Then fill in the required information in the chart. Repeat the above procedure until the total population exceeds 200 people.

PART B: The Effect of Instituting a Limited Birth Control Program

Return to the population you had after 10 years had passed. Put that many dice into the can. But now introduce a limited birth control program. This will be modeled by saying that a blue represents a birth, as before, and so does every other red. However, the remaining half of the red represent women who are on birth control and so a birth has been prevented. If an odd number of reds come up, round off in favor of a birth half of the time, and in favor of a reverted birth in the other half of the cases. Model this situation for the years 21 through 30. You have essentially cut the population growth rate from 17% to 8%.

PART C: The Zero Population Growth (ZPG) Plan

Return to the population you had after 10 years had passed. Put that many dice into the can. But now introduce a large scale birth control program. This will be modeled by saying that all the reds represent women using effective birth control techniques or women married to men using effective birth control techniques. Hence, a black represents a death, a blue represents a birth, and a red represents a prevented birth. Model this situation for the years 10-20.

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MODELING POPULATION GROWTH

Graphs and Conclusions:

PART A: Unrestricted Exponential Growth

Use your data to plot graphs of:

1. Population vs. Time (years)
   a. plot first on ordinary graph paper
   b. plot again on semi-log paper

2. Population Growth Rate vs. Time (years)

3. Population Growth Rate vs. population

Examine each graph and write a conclusion for each one

PART B: The Effect of Instituting a Limited Birth Control Program

Use your new data to plot graphs of:

1. Population vs. Time, 0-30 years. (ordinary graph paper)

2. Population vs. Time, 0-30 years. (semi-log graph paper)

Examine each graph, compare them to the Population vs. Time graphs in Part A, and then write a conclusion.

PART C: The Zero Population Growth (ZPG) Plan

Use your new data to plot graphs of:

1. Population vs. Time, 0-30 years. (ordinary graph paper)

2. Population vs. Time, 0-30 years. (semi-log graph paper)

Examine each graph, compare them to the Population vs. Time graphs in parts A and B, and then write a conclusion.

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MODELING POPULATION GROWTH

Data:
PART A: Unrestricted Exponential Growth

Throw No. (Year)	Number of Births (N_b)	Number of Deaths (N_d)	Number of Dice (population)	GROWTH RATE	POPULATION GROWTH RATE $\frac{\Delta N}{\Delta t} = \frac{N_b - N_d}{1} = \frac{\text{people}}{\text{year}}$
0	-	-	6	0%	
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
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16					
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28					
29					
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MODELING POPULATION GROWTH

Data:
PART B: The Effect of Instituting a Limited Birth Control Program

Throw No. (year)	Number of Births (N_b)	Number of Deaths (N_d)	Number of Dice (population)		Population Growth Rate $\frac{\Delta N}{\Delta t} = \frac{N_b - N_d}{1} = \frac{\text{people}}{\text{year}}$
				%	
20					
21					
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25					
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27					
28					
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30					

Data:
PART C: The Zero Population Growth (ZPG) Plan

Throw No. (year)	Number of Births (N_b)	Number of Deaths (N_d)	Number of Dice (population)		Population Growth Rate $\frac{\Delta N}{\Delta t} = \frac{N_b - N_d}{1} = \frac{\text{people}}{\text{year}}$
				%	
20					
21					
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Title: WORLD POPULATION (Film, 3 minutes, color)

Note: This film is readily available and is excellent in motivating students to better understand population dynamics.

Introduction:

To understand the dynamics of population growth, it is helpful for the learner to develop a sense of the historical patterns of this growth. World Population does this in a dramatic visual manner by demonstrating the growth of population on a world map from 0 A.D. to 2000 A.D. in about two minutes, using animation with dots. The film is an accurate presentation of world population growth in a way that will command student attention and interest.

Objectives:

To understand the patterns of rapid population growth worldwide.

To brainstorm explanations that would account for rapid population growth as depicted in the film.

Grade Level: 6 - 12

Time: 20-50 minutes

Materials: Film, World Population (1973), available from Perspective Films, 369 West Erie Street, Chicago, Illinois 60610, $69.00, rental $10.00, phone 312/977-4000.

Procedure:

1. Introduce the film briefly, explaining only that the film gives an overview of population growth in the world. This film may be shown as many as three times during the session. The impact of the first showing is usually sufficient to start the discussion. It is more effective to begin the discussion at this point with the "gut" reactions of the audience. The historic points are better left until the group has a chance to register their reactions to the film.

2. Show the film. The initial discussion should begin at the "feeling" level, using such questions as:

a. What are some one- or two-word reactions to what you just saw?
b. How would you describe the last 50 years of the film? Many feelings will not emerge immediately and the leader should not expect the reactions to be overwhelming. However, a half-dozen comments or feelings will set the tone for the rest of the discussion.

3. Once the tone has been set, the group should move on to more substantive questions to get at why the film took the turn it did. This may be easier to do by starting from the negative side, examining events which controlled population in the past. Suggested questions:
   a. Did anyone see any dramatic reduction in dots during the film? When and where? (Central America about the time of the Spanish conquests; Western Europe during the time of the Black Plague; Western Africa with the decline of the Nigerian empire; periods of major wars, etc.)
   b. What caused each of these declines? (Disease, war, genocide, famine, possibly migration patterns will show a slow down or stationary pattern in an otherwise growing area.)
   c. What were major growth areas, and why? (Historically, central river valleys; urban centers beginning with industrialization; migration during colonial eras, especially in the Americas.)

   At this point, you may suggest the film be shown again to point out and clarify some of these events to those who missed them the first time. At the same time, ask the group to concentrate on why the rate of growth seems to increase.

4. The final phase of discussion should focus on the exponential growth patterns. Suggested discussion starters:
   a. Does the overall growth tempo steadily increase, or does it go by spurts and stops? (Grows steadily but slowly until last 100 years when growth is rapid.)
   b. Do some of the factors previously identified as causes for declining growth have less impact today? (Disease particularly.)
   c. Does control of diseases have a double impact on population growth? This is an important question for the discussion and time should be spent either drawing out the answers or explaining the dual impact. (First, devastating plagues are almost nonexistent today. Second, medicine has greatly reduced infant and childhood fatalities and this results in greater percentages of the population reaching childbearing ages; hence greater growth, even if family sizes remain stable or decrease.)

Title: THE LETTER

Introduction: The student handout is a well written analogy reflecting the perspective of many people. As with any analogy, its utility is in the literary format. This format stimulates student interest in the topic of rapid population growth, its effects, and its relationship to the quality of life. Students examine the values that support such a situation, evaluating the positive and negative effects of those values.

Objectives:

To discuss the values that support the situation described in the reading.

To identify the values that support the situation described in the reading.

Grade Level: 10-12

Time: One class period

Materials: Copies of "The Letter" for every student

Procedure:

1. Discuss the fact that our behavior reflects our values. Hand out the reading to students.

2. Let students read the letter then answer the discussion questions. Discuss their answers.

3. Pose these questions to the class in a group discussion:
   a. What are the connections between the story and current trends in both the United States and world?
   b. To what extent does the letter accurately reflect the values of U.S. society today? Name some of the values.
   c. In what ways do these values promote increased population growth?

"People, Their Needs, Environment", Ecology, Volume I, by:
Bruce Wallace.

Dear Bruce and Roberta,

This has been a terrifying cruise. I will be thankful when we finally reach port. Wherever the ship first puts ashore, I will get off and fly home.

You would not believe how things have gone or what has happened. Remember the story about the woman who reported the lost elephant to the police sergeant? "This animal is pulling up my cabbages with its tail and you wouldn't believe what he does with them!" That is the way this trip has been--unbelievably absurd!

So few passengers had signed up by the time we sailed that we thought the cruise might be cancelled. All that is long past, but let me start at the beginning. Let me start with the Game! Immediately after we left the pier someone started this game of Monopoly. It turned out to be Monopoly for keeps. For keeps, believe me! When the bank first ran out of play money, someone suggested that the game could continue if we took parts of the ship--glasses, door knobs, faucet handles, and such things. Values were set by supply and demand; a perspiring man, you know, will pay a good deal to recover a missing shower head. The crew was tolerant; the purser, in fact, would reassign a passenger--for a price, that is--if the passenger himself had gambled and lost too many knickknacks from within his room.

Although we have never touched land since leaving the pier, the ship has rendezvoused on occasion with smaller boats and these have transferred passengers on board. At first this happened only infrequently, but the rate at which new passengers are put aboard has increased hand-inhand with the number already aboard. They now greatly outnumber the original passengers, and some rather recent arrivals complain about the large number of even more recent newcomers.

We no longer have empty staterooms aboard. For the most part we must share a room with several others. The rooms are in pretty bad shape, of course, because of the Game. The latest craze has been to take the glass discs from the portholes. Most of these have been stolen for "Easter Island" cash and have been replaced by wood. It is impossible to look out, but, as the newcomers say, "There's only water out there anyhow."

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The ship is becoming ill-kempt; the filth is very bad. There are far too many persons aboard. Furthermore, the facilities have been impaired by constant thievery. The rest rooms are no longer adequate. Impatient persons long ago began relieving themselves in dark passageways and obscure corners. Now, of course, it is necessary to do this regularly because of the number of persons aboard, and so these passageways and corners are officially designated latrine areas. I have recently noticed, however, that the more impatient passengers, because of the increased congestion, are relieving themselves quite publicly. Even well-lighted and well-traveled areas have become nasty underfoot.

We had quite a scare the other day--a terrible experience. One of our more enthusiastic and successful players found a metal plug protruding from the wall and, after a great deal of effort, pulled it out for use in the Game. To everyone's horror, water poured in. It seems as if we are now down to the hull itself. Many passengers are irate and have demanded that the hull be declared "off limits." The man responsible, however, bought a full-page ad in the ship's paper to explain glibly the hull has now been reinforced with patching plates and, as a result, is actually stronger than it was when we sailed. This statement has reassured many. We all gratefully contributed to the fund for the sailors who risked their lives getting the patches in place. Other ardent players have pointed out, in the meantime, that these plugs are essential to the Game, and if it is to continue, they must be removed whenever and wherever they are found. These players admit that there is a slight risk that the ship might sink, but they insist that the make-shift patches, though unsightly, are not dangerous. They seem quite confident that nearly any hole in the hull can be successfully repaired. In reference to the danger of the ship's going down, they say, "Not one chance in a billion."

You can see how things have gone and why I say, "What a cruise!" The fun is long gone. The Game rolls on at an ever-increasing pace. The small boats swarm about us now in great numbers with more and more passengers to be put aboard. The filth piles up. There is a chill that comes from thinking how things are going aboard this ship and what the outcome may be. Some passengers have demanded that the captain stop the ship; they want to get off. Those caught up in the frenzy of the Game, sensing the animosity of many that is aimed at them, have resorted to garish signs reading, "Love It or Leave It."

At any rate, I shall write again when I get a chance. In the meantime, if I thought any one would or could believe it, I would write a book. . .

Love to all,

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DISCUSSION QUESTIONS

1. To what extent does the letter accurately reflect the direction of values in American society in the last of the 20th Century?

2. What are the sources of a value system that would result in the attitudes and behaviors as reflected in the letter?

3. What changes would be influential in bringing about a different societal value system and what role could the schools play in the process?

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Title: THE NUMBERS GAME

Introduction: Students often find a demonstration of world population distribution compared to resources to be an excellent way to communicate the uneven distribution of each in relation to the other around the world. This activity has students representing population of world geographic areas, and it documents resources distribution in that context for the year 1974 and projected for the year 2000.

Objectives:

To demonstrate the distribution of population in the world.

To demonstrate the relationship between population growth and resource distribution.

Grade Level: 6-12

Time: One class period

Materials: Floor map of the continents;
75 pieces of candy, such as "Tootsie Rolls" or other small tokens.

Procedure:

1. The game should be held in a space large enough to accommodate movement and give some simulation of the division between the various continents. Ideally, the outline of the continents would be drawn on the floor, so the participants would have a sense of identification with a particular continent.

2. Acquaint students with the layout of the continents on the floor. Tell students that they will be assigned to various parts of the world to represent its population according to present estimates. Students should be divided as accurately as possible; the table that follows shows how a class of 30 students should be divided.

3. After distributing 15 of the students, hand out the tokens to those 15 students according to the table. Hold the United States until last. It will be obvious that the Unites States has far more resources than other parts of the world.

4. Following this distribution, the class should be told that they are in a time machine and are travelling to the year 2000 to see what the world population and resource distribution will be like, according to present trends. Divide the rest of the class, and distribute the remaining resources according to the chart.

5. When the final distribution has been completed, the teacher should step out of the activity. Encourage the students to work out a way to deal with the resource inequity. Students can move themselves (population) around and redistribute their food (resources). After students have spent about 20 minutes trying to solve the inequity, stop the activity.

6. Discussion of the exercise should focus on population distribution, resource allocation, and the feelings of students during the game. Try to relate their discussion to global problems.

	1974				2000			
Continent	Actual Population	% of World	Student Distribution	Resource Distribution	Act. Pop.	% of World	Student Distribution	Additional Resources
North America	222 million	6	1	15-20 each	354 million	6	1 + 1	20-30 additional to 1968 and 2000 population
Latin America	268 million	8	2	1 each	638 million	10	2 + 2	1 additional to 1968 population 1 to 2000 population
Asia	1.9 billion	54	8	1 each	3.5 billion	57	8 +8	1 additional to part of 1968 population 1 to part of 2000 population
Africa	333 million	10	2	1 each	768 million million	13	2 + 2	1 additional to 1968 population 1 to 2000 population
Europe	455 million	13	2	2 each	527 million	8	2 + 1	2 additional to 1968 population 2 to 2000 population

Title: NOBODY EVER DIES OF OVERPOPULATION

Introduction: Overpopulation is a difficult topic to get people concerned about. Normally, people are only concerned with immediate problems that have observable personal effects. In this article, Garrett Hardin explains how overpopulation relates to most causes of death, even if people do not choose to see the problem as a serious one.

Objectives:

To become aware of how overpopulation problems relate to death.

To consider overpopulation affects on the quality of life.

Grade Level: 9-12

Time: One class period

Materials: Copies of "Nobody Ever Dies of Overpopulation" for each student

Procedure:

1. Ask students how too many people can affect the quality of life. Briefly discuss this idea.

2. Hand out the reading by Garrett Harding for students to read.

3. Discuss the article.
   a. Why would Garrett Harding want to associate overpopulation with death?
   b. What is the "message" of the article?
   c. Do you agree that overpopulation should be seen as a serious "life and death" issue?

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SUMMARY. Briefly discusses several causes of death, strongly implying that most of the causes are related to overpopulation—a thought most people would rather not consider.

NOBODY EVER DIES OF OVERPOPULATION*

by Garrett Hardin

Those of us who are deeply concerned about population and the environment—"econuts," we're called—are accused of seeing herbicides in trees, pollution in running brooks, radiation in rocks, and overpopulation everywhere. There is merit in the accusation.

I was in Calcutta when the cyclone struck East Bengal in November 1970. Early dispatches spoke of 15,000 dead, but the estimates rapidly escalated to 2,000,000 and then dropped back to 500,000. A nice round number: it will do as well as any, for we will never know. The nameless ones who died, "unimportant" people far beyond the fringes of the social power structure, left no trace of their existence. Pakistani parents repaired the population loss in just 40 days, and the world turned its attention to other matters.

What killed those unfortunate people? The cyclone, newspapers said. But one can just as logically say that overpopulation killed them. The Gangetic delta is barely above sea level. Every year several thousand people are killed in quite ordinary storms. If Pakistan were not overcrowded, no sane man would bring his family to such a place. Ecologically speaking, a delta belongs to the river and the sea; man obtrudes there at his peril.

In the web of life every event has many antecedents. Only by an arbitrary decision can we designate a single antecedent as "cause." Our choice is biased— biased to protect our egos against the onslaught of unwelcome truths. As T. S. Eliot put it in *Burnt Norton*:

"Go, go, go, said the bird: human kind
Cannot bear very much reality."

Were we to identify overpopulation as the cause of a half-million deaths, we would threaten ourselves with a question to which we do not know the answer: *How can we control population without recourse to repugnant measures?* Fearfully we close our minds to an inventory of possibilities. Instead we say that a cyclone caused the deaths, thus relieving ourselves of responsibility for this and future catastrophes. "Fate" is so comforting.

Every year we list tuberculosis, leprosy, enteric diseases, or animal parasites as the "cause of death" of millions of people. It is well known that malnutrition is an important antecedent of death in all these categories; and that malnutrition is connected with overpopulation. But overpopulation is not called the cause of death. We cannot bear the thought.

People are dying now of respiratory diseases in Tokyo, Birmingham, and Gary, because of the "need" for more industry. The "need" for more food justifies overfertilization of the land, leading to eutrophication of the waters, and lessened fish production—which leads to more "need" for food.

What will we say when the power shuts down some fine summer on our eastern seaboard and several thousand people die of heat prostration? Will we blame the weather? Or the power companies for not building enough generators? Or the econuts for insisting on pollution controls?

One thing is certain: we won't blame the deaths on overpopulation. No one ever dies of overpopulation. It is unthinkable.

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Title: POPULATION PROJECTIONS*

Introduction: In this activity, students use calculators to understand exponential growth and make simple population projections.

Objectives:

To help students understand exponential growth by using calculators.

To make population projections with calculators.

Grade Level: 6-12

Time: One class period for every two worksheets attempted

Materials: At least one standard calculator (pocket-type is fine) for every two or three students in your class; copies of "Calculating Population Growth" worksheet for each student.

Procedure:

1. Hand out the worksheets to students.
2. Discuss the initial reading with the students after they have read it.
3. Have students complete the worksheets.

*This activity was developed by John Masoncup.

CALCULATING POPULATION GROWTH

Assumptions about Exponential Population Growth Rates

Population growth is exponential. Exponents are used in mathematics as a shorthand to denote repeated multiplication. For example, in the number 10^7, 7 is an exponent. The 7 means you multiply by 10 seven times: 10x10x10x10x10x10x10. Population grows exponentially because it is repeatedly multiplied by a number called the growth rate. Thus, if a world population of 4 billion has a growth rate of 2% per year for 7 years, the population will be $4\ (1.02)^7$ billion.

The growth rate represents the net gain of people per year. Roughly speaking, the birth rate - the death rate = the growth rate. Thus, to decrease the growth rate there must be a decrease in the birth rate or an increase in the death rate, or a combination of the two. People moving in and out by migration also have to be added and subtracted, but on a national basis the long-term effects of migration are usually less than those of births and deaths.

The significant fact about exponential growth is that even small growth rates lead to a large overall growth in population. Further, the growth is much faster than you might expect. For instance, it seems reasonable that with a growth rate of 2% the world population would double in fifty years to make a 100% increase. But in reality a growth rate of 2% causes a doubling of the population in only 35 years. This is because exponential growth is compounded much like compounded interest in a bank account.

A skeptic may well observe that these population projections may be true in theory, but that the predictions are not accurate because the growth rate will probably not remain constant. Such skepticism is well justified because, in fact, population growth rates do vary depending on a variety of social and cultural factors. Are population projections therefore worthless? Are the prophets of doom unduly alarming the public? Isn't it quite likely that the population will not grow as large as predicted, and so there is really nothing to get excited about?

Remember, the growth rate will decline only if the birth rate is decreased or the death rate is increased. Thus, if we expect the growth rate to decline, are we anticipating a reduction in birth rate? If so, what policies are now in effect or what social movements are occurring that will decrease the birth rate? Or perhaps we see trends that will lead to an increase in the death rate. The interplay between a variety of factors influencing birth rates and death rates will cause the overall growth rate to vary. But even if the growth rate is reduced, as long as it is greater than zero we have not resolved the conflict imposed by an exponentially growing population dependent upon limited resources. We have simply bought some time.*

There is also the question of lead time. If the leaders of a country decide to try to decrease the growth rate by decreasing the birth rate, they will not be able to accomplish this overnight. It could take at least

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*Paul Ehrlich, The Population Bomb, Ballantine Books, New York, N.Y., 1970, pp. 34-35.

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a generation to effect the policies and for the reduction to have a significant effect in leveling off the population growth. (To understand this effect better, run some experimental data in Option 6 of the POPPAK computer program.)

In conclusion, population projections cannot accurately tell us what the population will be in some future year because growth rates are neither constant nor perfectly predictable. But they can warn us of the worst possible consequences of continued growth at present rates or give us some idea of the best possible outcome of reduced rates. And hopefully, such projections can stimulate discussion of the perplexing alternatives that must be considered among different methods of changing the growth rate.

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CALCULATING POPULATION GROWTH WORKSHEET #1

Using a Calculator to Compute Population Growth

To use % growth rates on a calculator, change the % to a decimal and add 1. Complete the table.

	% of growth rate	decimal rate	each year multiply by
1)	.8%	.008	1.008
2)	1.5%	.015	1.015
3)	2.0%	.02	1.02
4)	3.4%		
5)	1%		
6)	.5%		
7)	2.2%		
8)	3%		
9)	2.9%		
10)	1.7%		

To find the decimal rate, take the % rate and move the decimal point 2 (two) places to the left.

To find what number to multiply by, put a 1 in front of the decimal rate.

If your calculator has a memory, store the rate you multiply by each year so you won't have to punch it in each time.

If your calculator has a % key, you do not need to change the growth rate to a decimal. For instance, if the growth rate is 1.5%, enter the population and just punch + 1.5 % = for each year of growth.

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CALCULATING POPULATION GROWTH WORKSHEET #2

Projecting Population Growth with a Calculator

In 1980 Mexico's population was 68.2 million, and its annual growth rate was 3.1 percent. If this growth rate stays the same, what will the population be in the year 2000? In 2010? (3.1% = .031 Each year, multiply by 1.031.)

YEAR	POPULATION	YEAR	POPULATION
1980	68.2	1996	
1981	68.2 x 1.031 = 70.3	1997	
1982	70.3 x 1.031 =	1998	
1983		1999	
1984		2000	
1985		2001	
1986		2002	
1987		2003	
1988		2004	
1989		2005	
1990		2006	
1991		2007	
1992		2008	
1993		2009	
1994		2010	
1995			

In 1980 the estimated population of the United States was 222.5 million and the growth rate was 0.7 percent. Construct a similar population chart of the United States going to the year 2010.

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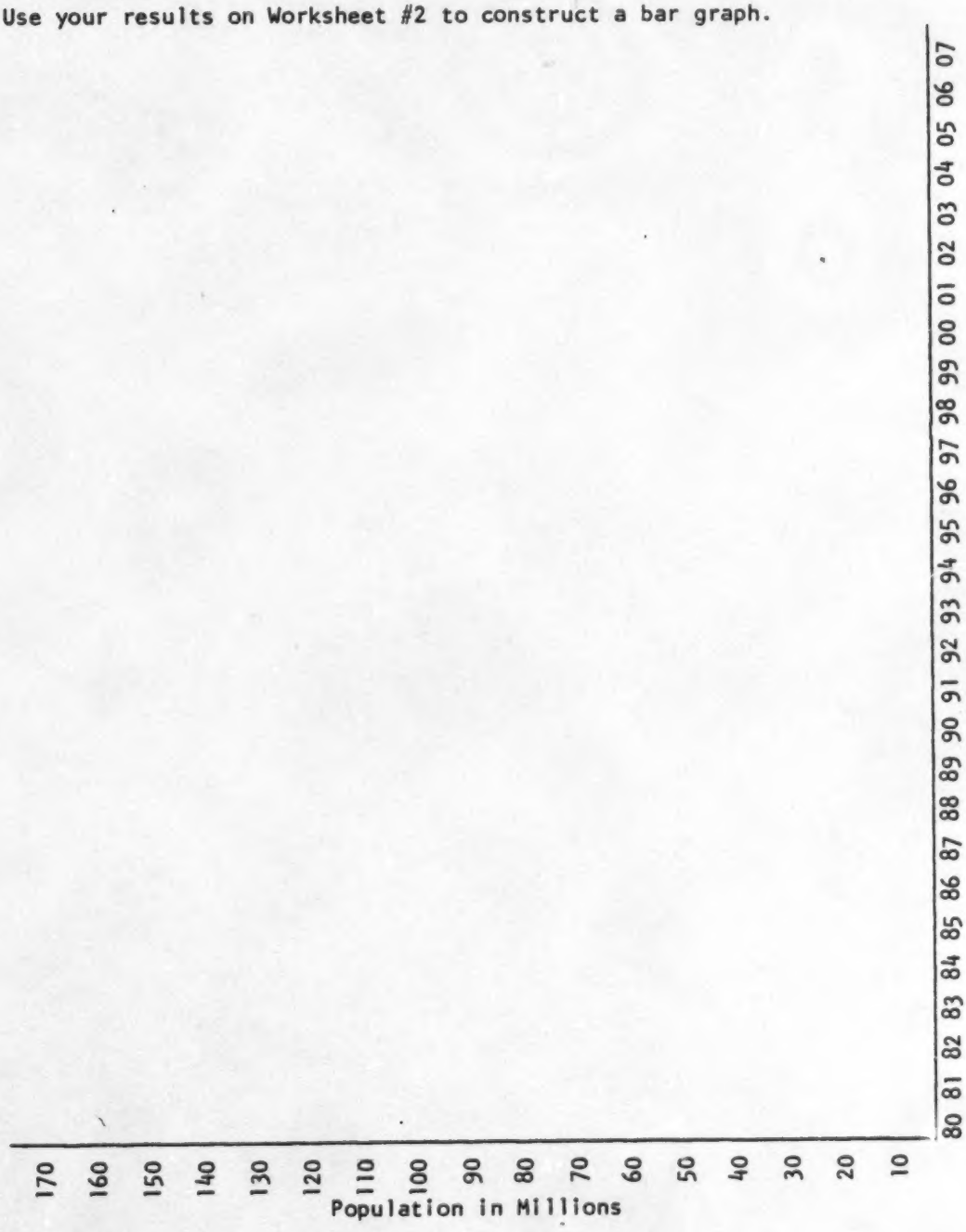
CALCULATING POPULATION GROWTH WORKSHEET #2A

Bar Graph for the Population Growth of Mexico

Use your results on Worksheet #2 to construct a bar graph.



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CALCULATING POPULATION GROWTH WORKSHEET #3

The Population Race

In 1980 Mexico's population was 68.2 million and the growth rate was 3.1 percent. In that year the population of the United States was 222.5 million and the growth rate was 0.7 percent. If the growth rates remain the same, in what year will the population of Mexico surpass that of the United States?

Use two calculators, one for you and one for your partner. Calculate the growth of the United States while your partner calculates the growth of Mexico. After each calculation, compare answers. Keep track of the number of multiplications needed before Mexico passes the United States. Write the year, the future population of Mexico in that year, and the population of the United States in that year.

1. Number of years for Mexico to pass U.S. _____

   \+ 1980

2. Year when Mexico passes U.S. _____

3. Population of Mexico _____

4. Population of United States _____

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CALCULATING POPULATION GROWTH WORKSHEET #4

Finding Doubling Times on a Calculator

In 1980 the population of the world was about 4.4 billion and the growth rate was 1.7 percent. If that growth rate continues, how many years will it take the world's population to double?

Enter 4.4 on your calculator. Repeatedly multiply by 1.017. Count how many times you have to multiply to obtain 8.8 or more for your answer.

Doubling time = _____ years

Doubling time depends on growth rate, not on population. In 1980 the growth rate of both Mexico and Ghana was 3.1 percent. How many years will it take for the population to double if the growth rate is 3.1 percent?

Doubling time = _____ years

Find the doubling times for the following growth rates.

GROWTH RATE	DOUBLING TIME
.5%	
1.0%	
1.5%	
2.0%	
2.5%	
3.0%	
3.5%	
4.0%	

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Title: PEOPLE PER SQUARE KILOMETER*

Introduction: Students often have no idea about how a country's population is related to its land area. This activity is designed to show students the relationship. Some statistics used in population studies can be misleading. Population per square kilometer is an example of misleading statistics. It is a measure that is standardized to aid in analysis, but it is not an accurate designation of where people are located. In this activity, students can practice understanding just what this statistic represents.

Objectives:

To determine the meaning of population per square kilometer statistics.

To suggest possible uses of population per square kilometer statistics in population studies.

Grade Level: 6-12

Time: One class period

Materials: Copies of "People Per Square Kilometer" for every student

Procedure:

1. Ask students what the statistic population per square kilometer means. Point out in an atlas how such a statistic is represented. (By color coding.) The students should be told that the statistic is an average to demonstrate the relationship between population numbers and land area.

2. Distribute "People Per Square Kilometer" to each student. Have them complete the handout.

3. Discuss the work completed.
   a. What does the statistic tell you?
   b. What does the statistic not tell you?
   c. How does it compare to population distribution statistics?
   d. How can the data be used for studying factors related to overpopulation?

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*Adapted from an activity by Sharon Willsea, Aurora Public Schools, Aurora, Colorado.

Answers:

COUNTRY	NUMBER OF PEOPLE PER SQUARE KM
People's Republic of China	97
Bhutan	26
France	97
West Germany	247
United States	23
India	194
Angola	5
Kenya	25
Japan	309
Australia	2
Netherlands	341
Malta	1076
Singapore	4017

PEOPLE PER SQUARE KILOMETER

The statistic people per square kilometer is used to demonstrate the relationship between population size and land area within a country. A country may have fewer people than another, but be more densely populated. This statistic explores that relationship.

Below are population figures and square kilometer figures for some selected countries. To find the number of people per square kilometer, divide the population by the square kilometers.

$$\frac{\text{population}}{\text{square kms}} = \frac{933,032,000}{9,596,691} = 97 \text{ people per square kilometer}$$

Then, using dots, letters, or whatever you choose, put the number of people per square kilometer in two 7x7-inch squares provided and write the name of the country. Do this chart for three or four countries.

Figure the population per square kilometer for all of the countries.

	SQUARE KM AREA	POPULATION	NUMBER OF PEOPLE PER SQUARE KM
People's Republic of China	9,596,691	933,032,000	97
Bhutan	47,000	1,240,000	
France	547,026	53,278,000	
West Germany	248,577	61,300,000	
United States	9,363,123	218,059,000	
India	3,287,590	638,388,000	
Angola	1,246,700	6,732,000	
Kenya	582,646	14,856,000	
Japan	372,313	114,898,000	
Australia	7,686,848	14,249,000	
Netherlands	40,844	13,936,000	
Malta	316	340,000	
Singapore	581	2,334,000	

The data used in this activity were taken from the 1978 UN Demographic Yearbook and may differ from those used in other activities in this unit.

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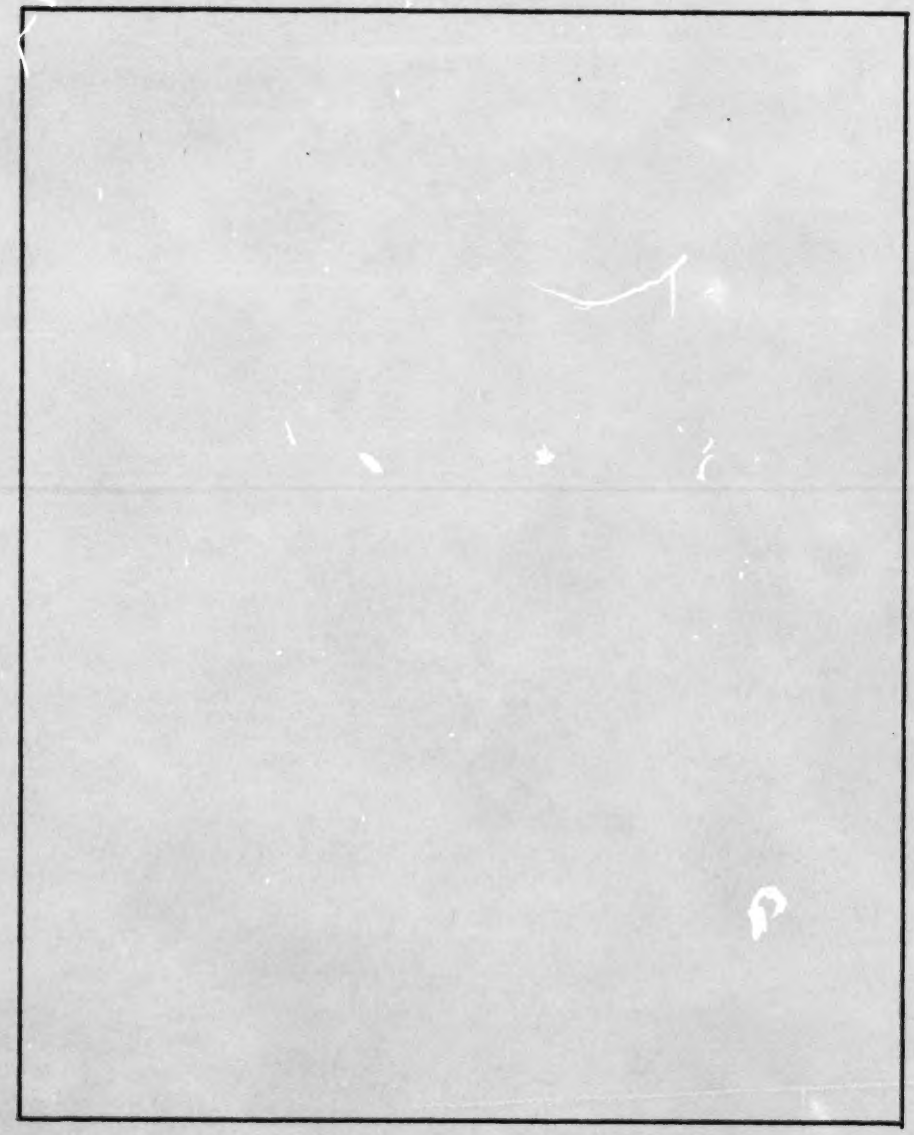
PEOPLE PER SQUARE KILOMETER



Country

171

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EVALUATION QUESTIONNAIRE

The Center for Teaching International Relations is interested in receiving your comments regarding teaching about population growth. Please fill out this questionnaire and return it to the address below.

1. Which of the activities did you find most useful, and why?

2. Which of the activities did you find least useful, and why?

3. What suggestions do you have for improving this unit?

If you have materials on population dynamics that you or your school district have developed and wish us to look over and consider for publication, feel free to send us copies.

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